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ABSTRACT

This elementary school unit on wetland ecology consists of 12 activities and activity packets containing data sheets, activity sheets, flash cards, game cards, and other materials needed to complete the activities. The first activity is the text for a slide-tape show which provides an overview of the entire unit. Each of the remaining activities is then presented under five headings: (1) objective; (2) background; (3) activity; (4) summary; and (5) going further. The objective tells what students can gain from doing the activity. The background gives information about the subject matter of the activity and, when applicable, explains why the activity is important. The summary consists of several questions to be answered after the activity is completed. Going further is a section with suggestions for additional activities. Among the topics considered in the activities (which may be completed in any order) are identifying wetland plants and animals, endangered wetlands, human life in these areas, wetland arts and crafts, how to visit a wetland, and the wetland environment (freshwater marshes, saltwater marshes, swamps, and bogs). (JN)

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Hanging on to the Wetlands

Book I

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Hanging on to the Wetlands

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Cover art by Ron K. Sorensen

An Introduction to the Student

Hanging on to Our Wetlands is a unit on ecology. You will learn about a special kind of environment known as a wetland. This unit consists of 12 activities. Each activity is introduced in this book. Activity materials are contained in the 12 pockets of the canvas frame.

Activity #1 is a slide/tape show. This program will give you an overview of the entire unit. In the first part you will find out what a wetland is. Then you will see examples of different kinds of wetlands. Pictures of plants and animals of the wetlands will introduce you to the special features of wetlands. The next part of the program explains why wetlands are important. Then a series of slides describes what happens to wetlands after humans change them. Finally, the show considers the actions people take to protect and preserve wetlands.

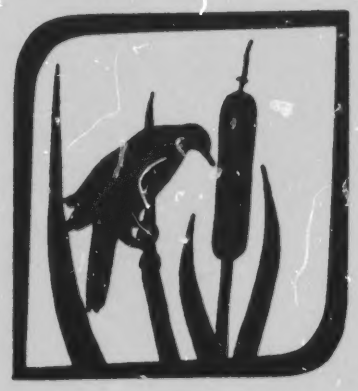
After the slide/tape show you will select activities to do. The eleven remaining activities are numbered in order of their introduction in the slide/tape show. However, you do not have to do the activities in any particular order. You might choose to do Activity #8 first and Activity #3 second. But before you decide which activity to do first, look over all of the activities. They are described in this book.

Each of the eleven activties is presented under five headings: OBJECTIVE; BACKGROUND; ACTIVITY; SUMMARY; and GOING FURTHER. The OBJECTIVE tells you what you can gain from doing the activity. The BACKGROUND gives you some important information about the subject of the activity. This section may also explain why the activity is important. The ACTIVITY tells you what you will be doing and how to go about it. The SUMMARY section consists of several questions. You should be able to answer these questions after you do the activity. GOING FURTHER is a section with ideas about more things to do. This section is for students who find the activity especially exciting.

The twelve pockets in the canvas frame contain the guidesheets, references, and a few of the materials you will need to do the activity. You will have to

gather some of the materials from school or home. Books for further reading will have to be found in a library.

Near the close of your unit study you may want to watch the slide/tape show again. After doing some of the wetland activities, you may see some new things in the slide/tape program.



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1 An Introduction to Wetlands

1. This slide program is about wetlands.
2. It will be your guide in learning about swamps, bogs, and marshes.
3. You'll learn about the plants and animals which live there.
4. And the importance of wetlands to humans.
5. TITLE SLIDE: "Hanging on to our Wetlands."
6. The word wetlands means just that: Lands that are wet most of the time.
7. For example, look at the land around the mouth of this river. This land may be under water much of the year. If the water comes from the ocean, it will be salty. Then the area is called a saltwater marsh.
8. In other places, land is covered by shallow lakes of fresh water. The water comes from beneath the ground, from streams, or from flooded lands nearby. These are freshwater marshes.
9. You may recognize a swamp. Swamps are usually covered with water in the winter and spring. But they often dry up in summer.
10. Bogs are found in many parts of the country. They are formed when hollows in the ground fill with water. There is usually no place for water to drain out of the bog. Dead organisms collect in bog water. The water changes over time.
11. In activity 2 you will learn more about each type of wetland. You should also visit a wetland if you can. That's the best place to learn about a swamp, bog, or marsh. Activity 3 is on field trips. It tells you how to visit a wetland.
12. All wetlands are alike in some ways. First of all, the soils in them hold water well. Muck and clay are common in wetlands. So is this sphagnum moss. In bogs it acts like a sponge, soaking up and holding water.
13. The one feature found in every wetland is, of course, water. It may be salty or fresh; warm or cold; acidic or neutral; next to the ocean or inland. About the only common feature of water in wetlands is that it is usually shallow.

14. Wetland plants are often different from plants on dry land. They are able to live in very wet areas. Some float on top of the water. Others have roots that are under water most of the time.

15. Wetlands provide homes for many animals, too. In fact, more kinds of animals live in wetlands than in any other land or water region. Why do you think there are so many ducks here?

16. The organisms that live in a wetland depend on one another closely. The life of any one plant or animal is strongly affected by the lives of everything else around it. Here a water snake is eating a bullhead snake. This is part of a food web. You will learn more about food webs in activity 4.

17. But wetlands differ from each other, too. The water in a bog is acidic and low in oxygen. It lacks nutrients that plants need. Most plants can not survive there. The pitcher plant shown here is an exception. It captures insects and digests them. This is how it gets nutrients that are not found in bog water.

18. The pitcher plant shows how plants adapt to special conditions. Here is another example. Spartina lives in salt marshes. It is adapted to an environment of salty water, where few plants live. Spartina has special cells which allow it to get rid of excess salt through its stalk.

19. Here's another method that wetland plants use for survival. The roots of this cypress tree are under water most of the year. How can they get oxygen then? Some people think that these "knees" may be the answer. Perhaps they help carry oxygen to the tree's roots.

20. Most of us are interested in wetlands. We want to learn more about plants and animals that live there. In activity 5 you will learn the names of many wetland organisms. Activity 6 shows how to study one of these. How many of these wetland organisms do you already know?

21. - 29. ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓

30. Wetlands are good for humans. Many plants and animals grow very well there. Most could not grow anywhere else. Many times humans depend on the food that grows in wetlands. This rice field is important for people who live in Hawaii. Can you think of other foods we get from wetlands?

31. Humans use wetlands in other ways, too. Many people enjoy bird-watching. Others like to hunt and fish. A healthy wetland contains many types of plants and animals. They provide us with many forms of recreation. Some people want to protect wetlands for this reason.

32. Swamps and marshes reduce flooding. Soil under these wetlands is good at soaking up water. In a heavy rain, a wetland can take away much of the extra water. This prevents homes and other buildings from being flooded. Activity 7 shows how wetlands help control floods.

33. Wetlands are also natural filtering systems. Some wetland plants have ways of storing harmful wastes in their stems. Wastes that we dump into rivers and lakes are removed by marshes, swamps, and bogs. But that doesn't mean we should use wetlands for garbage dumps. They can handle only so much pollution. After that, they may be harmed or destroyed.

34. For many people, wetlands are a place just to relax. Have you ever been bird-watching? Swamps and marshes are nice places in which to see many kinds of winged friends.

35. Sometimes we only need to say that wetlands are beautiful places.

36. The things we see in a swamp. . .

37. . . . or in a bog can be seen nowhere else in the world.

38. A day on the wetlands can bring us peace, happiness, and a feeling of being at home with nature.

39. When wetlands are threatened, many people think first of the beauty and joy they bring to our lives.

40. Finally, wetlands have always been homes for humans. They have provided food, shelter, and transportation for people. That was true long ago. And it is still true today.

41. Activity 8 shows how to make a meal from wetland plants and animals. Activity 9 describes some art and craft projects using wetland materials. You could learn how to make a reed mat, as these students are.

42. Life in the wetlands, long ago and today, is the subject of Activity 10.

43. But humans have not always been kind to wetlands. Many things we do damage or destroy swamps and marshes. For example, farmers often fill marshes to make new farm land.

44. Humans are always looking for new land to build homes or to grow food on. Wetlands are very rich in nutrients. They often seem like good places for new farms. Here a marsh is being drained. Next year there will be corn growing here.

45. Of course, we may have to destroy the wetlands in the process. Which is better: To have new farms or to save wetlands? That can be a hard choice. There often is no simple "right" or "wrong" answer.

46. Many people like living near the water. A third of all Americans live within 50 miles of an ocean or big lake. Homes are often built on land that was once a wetland. Is that the best way to use wetlands?

47. Recall how wetlands help clean up wastes? But they can do only so much. Today, pollution in swamps and marshes is a serious problem. Some forms, such as oil, threaten the very life of wetlands. This oil-soaked bird, for example, may never be able to fly again. It will not be able to look for food or to escape from predators.

48. Beaver hats, alligator shoes, egret feathers, and fur coats like this one are all threats to wetlands, too. To get the things we want, we sometimes hunt an animal almost to extinction.

49. Filling wetlands also threatens wildlife. The whooping cranes have lost much of their feeding grounds to farmers and highways. Their nesting grounds have been changed and destroyed, too. Today, there are only a few dozen of these birds left. Your children may not be able to see a baby whooper like this one.

50. There may be a wetland in your own community that is threatened. Perhaps a swamp like this one is being filled in. In Activity 11, you will learn more about the dangers that wetlands face.

51. It's often hard to decide what is best for everyone: to leave wetlands alone or to change them for human needs. Citizens are getting involved in these decisions more and more.

52. One reason these decisions are difficult is that people do not always look at wetlands in the same way. For example, suppose that mosquitoes breed in this marsh. Some people may want to spray the marsh with pesticide.

53. Others will work to have the marsh left alone. They fear that other organisms will be harmed.

54. Still other people don't care one way or another. Activity 12 shows how to find out what people in your community think about wetlands.

55. These are decisions that YOU will have to make. Nearly 50 million acres of wetlands have already been lost in this country. Another million acres are threatened.

56. The Federal government has long been concerned about our wetlands. The first laws protecting them were passed in 1899. In 1977, the Clean Water Act was passed. Other laws have followed.

57. In this group of activities, we will try to show you the value of our wetlands. . .

58. . . . and some dangers they face. . .

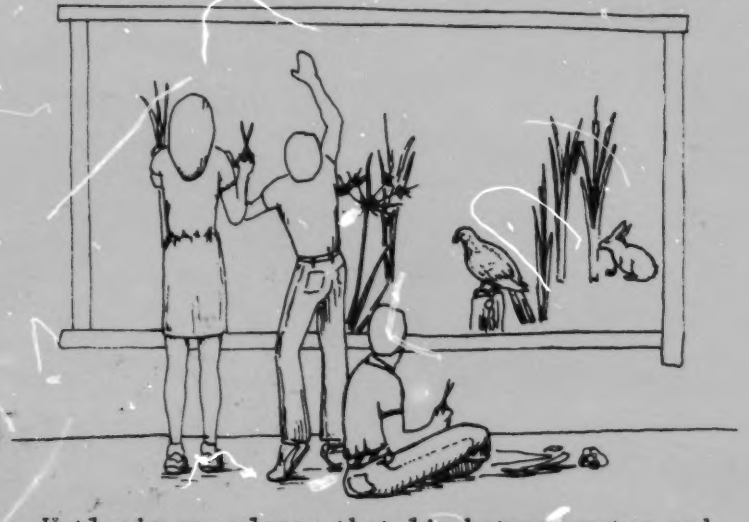
59. so that, when the time comes, you will make intelligent decisions about our swamps, marshes, and bogs.

2

Make a Wetlands Environment

OBJECTIVE

This activity shows what four different kinds of wetlands are like. You will choose to make a poster of a freshwater marsh, a salt marsh, a swamp, or a bog. Other students will choose to make posters of the other wetlands. What are the differences among marshes, swamps, and bogs? What are some of the plants and animals that live in wetlands?



BACKGROUND

Wetlands are places that lie between water and land. You can recognize wetlands best by the kinds of plants that grow there. Wetland plants grow only in soils that are water soaked most of the time. The water of wetlands can be fresh or salty, clear or murky, still or moving, warm or cold, sour or bitter. (Sour water has acid and tastes somewhat like lemon juice or vinegar. Bitter water tastes like milk of magnesia or unsweetened chocolate.) These special kinds of plants, soils, and waters provide homes and feeding spots for only certain kinds of animals.

We know a wetland by the organisms that live there. The kinds of water and soil present also tell us something about the wetland.

THE ACTIVITY

Activity Packet #2 contains four envelopes. They are labeled FRESHWATER MARSH, SALTWATER MARSH, SWAMP, and BOG. In each envelope are pictures of plants, animals, and microorganisms that live in that kind of wetland. Cut out each organism. Then paste all organisms to a sheet of butcher or poster paper. Make a scene for each wetland. Water and sky may be drawn in. You can also color in the plants and animals. Other plants and animals can be added to the poster.

Freshwater Marshes

Freshwater marshes are found throughout the United States. They usually occur at the edges of lakes, ponds, or slow moving rivers. Large numbers of soft bodied plants grow out of the soggy soil. Others float on the water. Some plants live completely under water. There is much plant life in these marshes. Many kinds and large numbers of animals live in freshwater marshes. Your poster may look something like this scene of a freshwater marsh.

Swamps

How does a swamp differ from a marsh? For one thing, the plant life is different. Marsh plants have soft stems. Swamp plants have woody stems. They are mainly trees and shrubs. The trees in a swamp cut off the sun. So swamps look like gloomy forests with flooded floors. Some swamps dry out during summers. Our picture on the next page shows a cypress swamp of southeastern United States.

Bogs

Bogs are very different from other kinds of wetlands. They form in "cups" in the ground. These "cups" have been gouged out of bedrock by glaciers. Very little water flows in or out of a bog. The water of a bog is sour. It contains little plant food or oxygen. The plant that lives best under these conditions is sphagnum moss. The moss grows out from the edge of the water. It forms a mat on the water. As old moss dies, it falls to the bottom of the bog. There it changes into peat. Eventually the peat fills the bog. Only very special plants grow on sphagnum moss. In its old age a bog becomes a spruce and larch tree forest in the north. In the southern United States it becomes a white cedar forest.

Saltwater Marshes

Saltwater marshes occur where salty water soaks the soil. They are commonly found near the oceans. But salt marshes can also be found inland. They can form wherever soils are salty. Examples of inland salt marshes are found at the edge of Utah's Great Salt Lake and California's Salton Sea. Only special kinds of seed plants can stand salty water around their roots, stems, and leaves. Animals move into salt marshes for the food and shelter the plants provide.

SUMMARY QUESTIONS

After the four posters have been put together and displayed, answer the following questions:

1. What is the same about all wetland environments?

2. In what ways do bogs, swamps, freshwater marshes, and saltwater marshes differ?

3. Name at least 2 plants which are characteristic of each type of wetland.

	Freshwater marsh	Saltwater marsh	Bog	Swamp
1.				
2.				

GOING FURTHER

1. Pond environments can be made in aquariums. Woodland environments can be made in terrariums. Try making a wetland environment in an aquarium tank.

2. Besides marshes, swamps, and bogs, what other kinds of wetlands are there? How are they different?

3
The Field Trip

OBJECTIVE

In this activity you will visit a wetland. There you will carry out a scientific study of one part of this special environment. You will also have a chance to get a feeling for a wetland. Smell it, listen to its sounds, touch its parts, and look at it from different angles.

BACKGROUND

Wetlands are environments in which certain kinds of living and nonliving things are found together. The organisms depend on one another for food and shelter. The organisms also depend on the water, the soil, the sunlight, and the temperatures in wetlands. Wetlands are delicately balanced systems. To understand the system of a wetland is to know all the parts and how the parts work together.

It is difficult to study all of a wetland at one time. The whole system of a wetland is very complex. The usual field study of a wetland involves three major steps.

1. The student looks over the whole wetland.
2. The student carries out a special study of one part of the wetland. The part studied may be the water, the soil, the birds, or the floating plants.
3. All students put their studies together. By listening to, reading, or looking at other student's reports, all students learn about the whole wetland system.

ACTIVITY

In Activity Packet #3 you will find an envelope labelled FIELD TRIP TASK CARDS. Inside the envelope are 12 printed cards. Each card describes one task. Carry out one of the tasks on a field study trip to a wetland. Choose the one you are most interested in using. The subjects on the cards are:

1. Insects in the Water
2. Frogs
3. Wetland Plant Collection
4. Insects in the Air and on the Land
5. Exploration with a Water Scope
6. Animal Signs
7. Temperature
8. Bird Watching I
9. Bird Watching II
10. Photography
11. Record an On the Spot News Broadcast for Station WETS
12. Mud

SUMMARY

Report the findings of your study in one of the followings ways:

1. Prepare a written report. Give it to your teacher. These reports may be displayed on a bulletin board, or made into a book.

2. You may decided to exhibit the results of your field study. You can display the things collected, pictures taken, or charts drawn.

3. You may choose to make an oral presentation. Certainly the recording of wetland sounds needs to be heard. The whole class together can discuss all the information collected.

GOING FURTHER

1. Repeat your study in a second wetland. How do the second results compare with the first?

2. Select a second study. Return to the wetland and carry it out.

4 Food Webs in Wetlands

OBJECTIVE

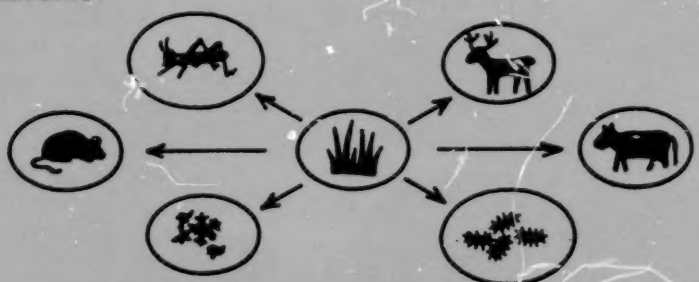
Organisms in wetlands are busy. Especially when they collect food and eat. . .each other. In this activity you will observe how plants, animals, and microorganisms depend on one another for food. In the first part of the activity you will build a food web while playing a game of rummy. After the game you will search for evidence of a food web in your natural surroundings.

BACKGROUND

No organisms lives alone and separate from other organisms. Every kind of organism is food for others. We can begin to see how food passes from organisms to organisms by starting with grass. Grass may be eaten by cattle.

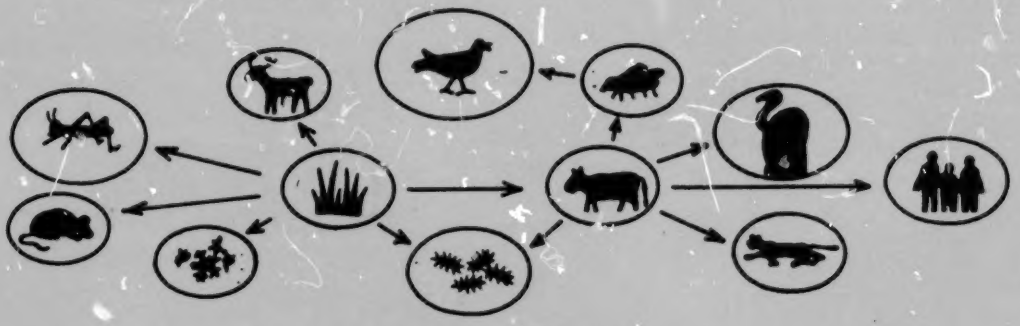
The milk or the meat of the cattle may be eaten by humans.

This eating line-up, called a food chain, does not show the full story. Grass is actually eaten by many creatures:



And cattle eat more than grass. They are also food for more than people.

By putting the FEEDING diagrams of grass and cattle together:



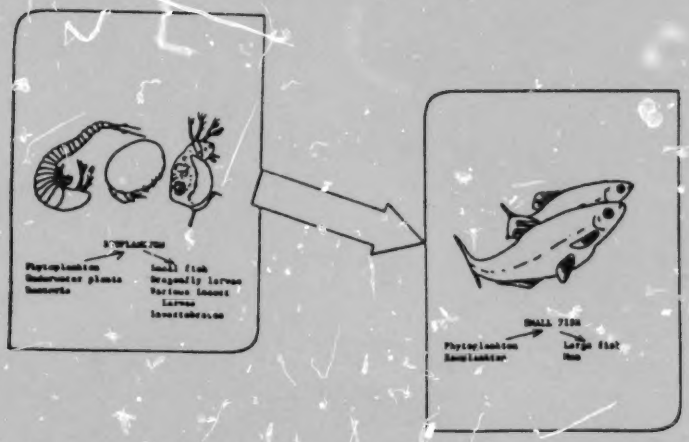
we find that the simple food chain turns into a complex food web. Biologists who study wetlands need to know what the food web looks like.

THE ACTIVITY

In Activity Packet #4 you will find a deck of cards and a supply of printed arrows. You can use these to play a Food Web Card Game. On the face of each card is a picture of an organism that lives in a typical freshwater marsh. The organisms are all related to one another in a food web. Each card lists what the organism eats and what eats the organism.

Directions to play the Food Web Card Game.

1. The game can be played by 2, 3, or 4 players.
2. Deal each player 3 cards down.
3. Place the rest of the deck face down in the middle of a table. The top card is turned over and placed next to the deck.
4. Also place the pile of arrows in the middle of the table.
5. The first player tries to use one of her/his 3 cards to show a true feeding relationship with the card that is face up. One of the arrows is used to do this.



6. If the player cannot play a card, he or she must draw additional cards until a card and an arrow can be played.

7. The other players in turn try to use cards from their hands in a similar way. Whenever cards in one's hands cannot be used, additional cards must be drawn from the deck.

8. The first player to use all the cards in his/her hand wins. However, the game should continue until only one player has cards left.

SUMMARY QUESTIONS

1. In food webs, which are the organisms that make the food in the first place?

2. Which are the organisms that are not preyed upon?

3. What happens to the other organisms in a food <u>chain</u> when one of the organisms disappears?

4. What happens to the other organisms in a food web when one of the organisms disappears?

GOING FURTHER

1. Use the cards of this game to invent a new card game. Or make a new set of cards and a new card game.

2. Follow up the food web card game by working out your own food web. You could begin by observing the feeding of organisms in your yard, a park, or other environment where there are plants and animals.

5 Study of a Wetland Organism

OBJECTIVE

In this activity you will carry out your own research project. Pick an organism that lives in a wetland. You can investigate how dragon fly larvae behave, or study the parts of a bulrush plant. Perhaps you will conduct an experiment to find out the kinds of insects leopard frogs prefer to eat.

BACKGROUND

When wetlands are mentioned many people immediately think about the plants or animals that live in wetlands. Cattails, marsh grass, cypress trees, and venus flytraps are symbols of wetlands. So are great blue herons, frogs, alligators, and water striders.

Much of our knowledge about wetlands is related to what we know about organisms. We always ask: What are the roles of the organisms in the wetlands? Where do they reproduce? How do they obtain food? Which organisms depend on other organisms for food or shelter? Are the organisms dying out? Why? These sort of questions go on and on and on. As soon as we answer one question, several new ones arise.

The job of the scientist is to deal with questions. Try to ask questions, answer those questions, and ask more questions.

THE ACTIVITY

In this activity you will:

1. Find an organism.
2. Observe the organism.
3. Ask a question about the organism.
4. Look for the answer to your question.
5. Ask more questions about your organism.

If necessary, set up an aquarium or terrarium to keep your organisms alive while you observe them. Activity Packet #5 contains some instructions on how to do this. Here are two examples of investigations of organisms of the wetlands.

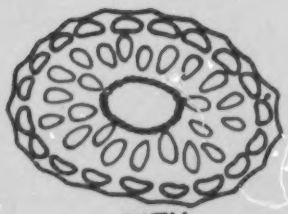
Example #1
Cattail Study

Collect some cattails. Carefully examine the roots, stems, leaves, and flowers. The flowers are all packed tightly together in the fuzzy brown thing that looks like a cat's tail. Make detailed drawings of the organs of the plant. Use a magnifying glass to study parts of the male and female flowers.

QUESTIONS

Leaves: What's inside cattail leaves that makes them stiff and hard to tear?

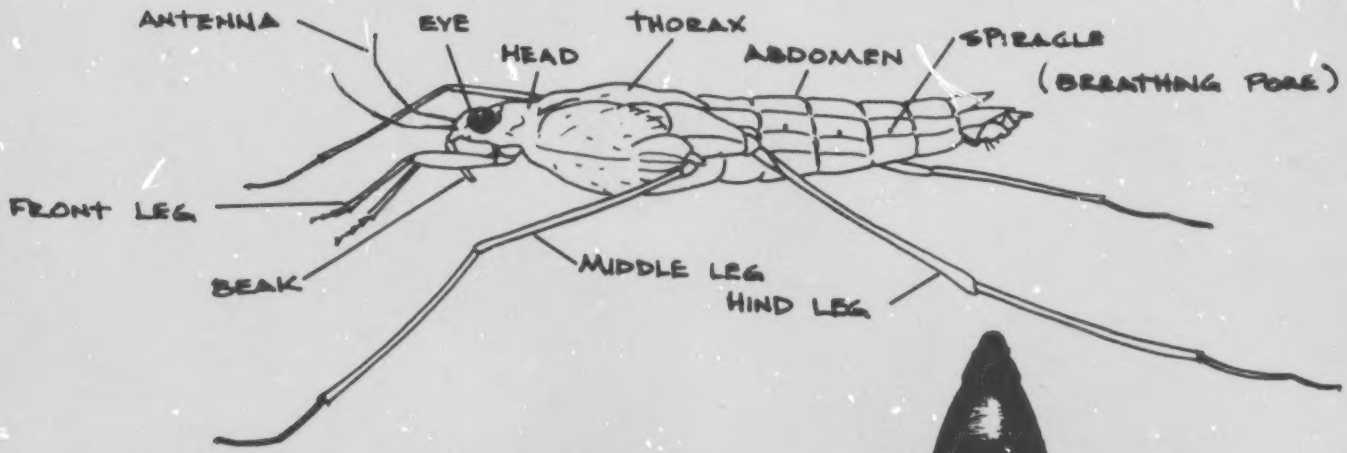
Stems: What does the pith in the middle of the stem look like? Observe slices of pith under a microscope.



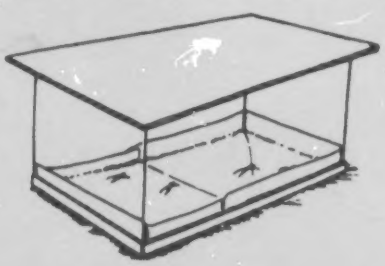
Flowers: What differences can you see between the kinds of flowers in the cattail?

Seeds: Put some seeds between layers of wet towelling. How long does it take for the seed to germinate and start growing?

Example #2 Use an insect net to collect some male and female water striders from the surface of a pond. At the same time gather other insects that live around the wetland. Cover the bottom of an aquarium with wet towelling. Place the water striders in the aquarium and cover it.



One at a time add the different kinds of insects that you collected from the freshwater wetland. Observe carefully what happens when you add each different kind of insect.



QUESTIONS

1. Which insects do the striders eat? Which insects don't the striders eat?

2. How do the mouths of striders work as they feed?

3. How long does it take for the eggs of striders to hatch?

SUMMARY QUESTIONS

1. Which organism of the wetlands did you study?

2. What did you learn, that you didn't know before, about the organism?

3. What new questions about your organism do you now want answered?

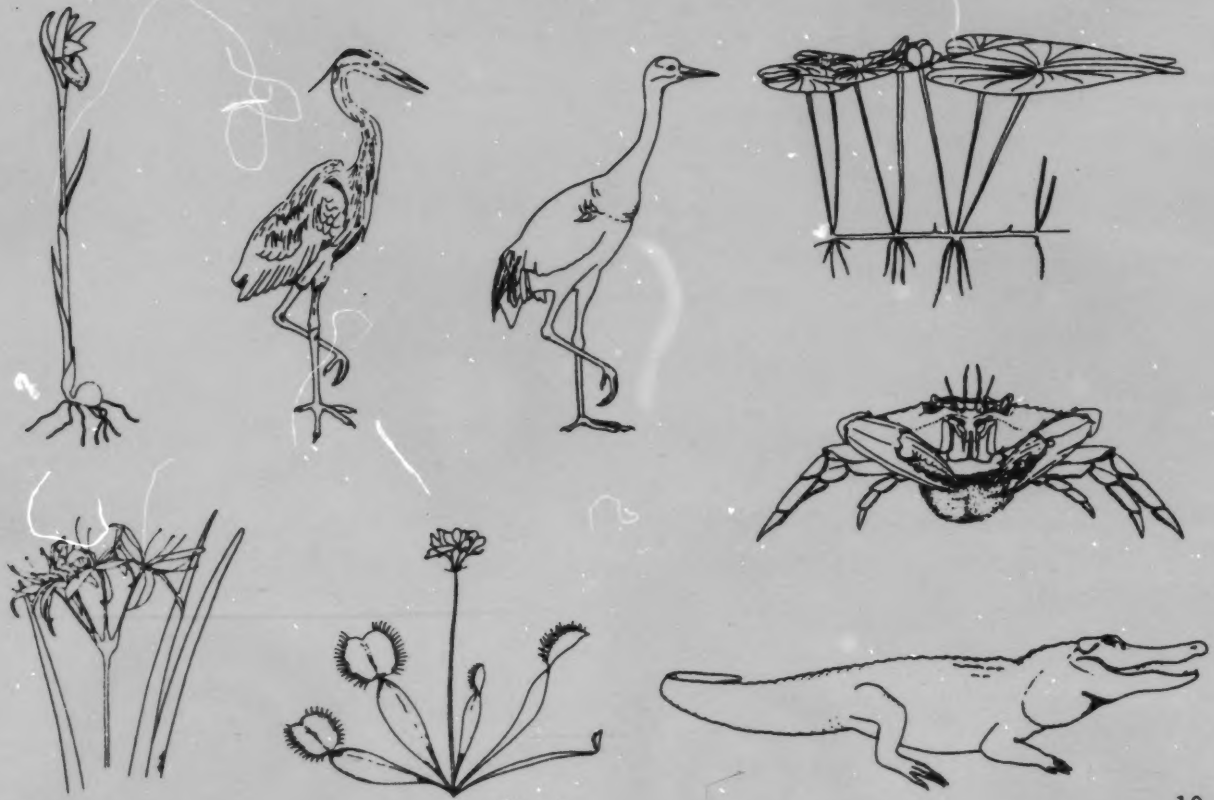
6 Identifying Wetland: Plants and Animals

OBJECTIVES

One way to recognize a wetland is by the plants and animals that live there. Saltwater marshes contain one set of organisms; freshwater marshes contain a another set. Bogs have yet another set; swamps, still another. Some organisms can live in more than one wetland. We can learn a lot about a wetland by knowing the plants and animals that live there. In this activity you will learn to recognize wetland plants and animals.

BACKGROUND

The pictures below show eight plants and animals that live in a wetland. Can you guess which wetland they are found in?



The point of this question is simple. Every organism is adapted to a certain environment. Plants and animals that live in a swamp are adapted to swamp conditions. They grow and reproduce best in the water, light, soil, and minerals found in a swamp. They would not survive as well in a bog or a salt marsh.

What happens if conditions in a wetland change? The effects on organisms that live there can be serious. Suppose that garbage is dumped into a swamp. The garbage begins to decay. It uses up dissolved oxygen. Animals that live under water would not be able to get the oxygen they need. They might suffocate and die. Plants also would be affected. Those growing on the bottom need light to survive. Cloudy water would cut out the light.

Suppose the water stayed dirty for many years. Some plants and animals might die out forever. We say they have become extinct in that area. Some organisms are threatened by changed environments. They are said to be endangered. Other organisms are said to be rare. They are not in danger of dying out. But they are not very common. Unless we are careful, they may become endangered.

Sometimes humans change living conditions in wetlands. Farms near a swamp can cause muddy water. That might produce the conditions described above. Cities may dump sewage into a marsh. This can threaten plant and animal life, too. Sometimes power plants make water too warm for plants and animals to live in. These are a few of the ways that humans are a threat to wetland organisms.

THE ACTIVITY

Envelope #6 contains 40 flash cards. Each has a picture of a plant or an animal on the front. Look on the back of the card. You'll find two important things to know about each organism. The first is the type of wetland in which it is found. The second is whether or not it is an endangered animal or plant.

1. The flash cards are arranged according to wetland groups. Choose any one of these groups. Memorize the name of each organism in the group. You should work with a friend. One of you can show the picture. The other one can try to name the organism. Then you can change places. The person who shows can become the person who names.

2. Pay special attention to those that are rare or endangered. Try to recognize an endangered or rare plant or animal when its picture is "flashed."

3. Learn one wetland area as well as you can. Then move on to a second one. Repeat this until you know the organisms in all four wetlands.

4. Now you are becoming a real expert in identifying plants and animals. Next, mix all four wetland groups together. You will then have all four groups in one pile. Have a friend show you these cards, one at a time. See if you can tell: (1) the name of the organism, (2) the wetland it comes from, and (3) whether it is endangered or not.

SUMMARY QESUTIONS

1. Name two plants and two animals that live in a

salt marsh	freshwater marsh
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____

bog	swamp
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____

2. Name four plants and animals that are endangered; four more that are rare.

endangered	rare
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____

3. What are some of the things that humans could do to protect wetland plants and animals that are rare or endangered?

4. Many organisms have become extinct in history. The dinosaurs are a good example. Is it bad that a plant or animal becomes extinct? Why or why not?

GOING FURTHER

Invent a game or a contest using these flash cards. For example, you could have a "spell-down" with these cards. Divide the class into two teams. The teacher's job is to show the flash cards to both teams. As long as a person gives the right answer, he or she remains standing. When a person is wrong, he or she must sit down. The team that loses all of its members first loses the game.

You could also make up a card game. Use the flash cards in a game like "Authors" or "Go Fish."

Work out the rules for one of these games or contests. Then try it out with members of your class. Play the game once. Then re-write the rules to make the game better.

7

Wet Land in the Wetlands

OBJECTIVE

Wetlands help protect against floods. In this activity you'll see why. You'll learn about flood protection. You'll see how it depends on the soil in wetlands. Wetland soils are usually good at soaking up water. You'll figure out how good different soils are as "soaker-uppers." When you've finished, you may know more about the flood control program in your community.

BACKGROUND

Let's begin with an easy puzzle. Below is a drawing of a wetland. But it hasn't been labeled. The terms that are missing are:

WATER HARD ROCK WET DIRT

Put the correct term in each box. Then go on with the activity.

The correct answers for this puzzle are:

1 = WATER 2 = WET DIRT 3 = HARD ROCK

The point of the puzzle is simple. Wetland areas are always just that: lands that are wet. We can't put HARD ROCK in box #2. Then there would be no wet land. Rock doesn't soak up water. It won't get soggy like dirt will.

In this activity you will find out how well certain materials soak up water. You can probably guess that dirt will soak up water better than rock. But what kind of dirt is the best "soaker-upper"? You'll know when you finish the experiment. Then you will under stand one way in which wetlands control floods.

THE ACTIVITY

1. In this activity you will compare the way different materials soak up water. The materials you will need to locate are:

a. sphagnum moss	a sample is found in Activity Packet #7
b. peat moss	found in any plant store or nursery
c. sod	a small piece from your front yard
d. sand	from a sandbox or beach
e. rock	a small piece from almost anywhere

Weigh out a sample of each material. Each of the five samples should weigh about the same. Don't worry too much if they don't.

2. The equipment you'll need is:

a. An ordinary kitchen sieve

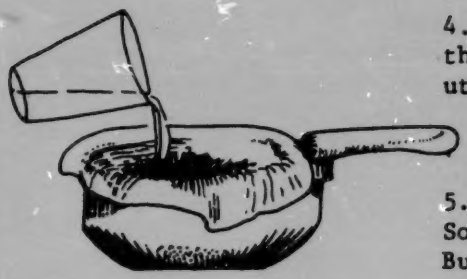
b. A piece of cheesecloth large enough to cover the whole sieve

c. A bowl large enough to hold the sieve

d. A scale

When the first three are put together they make a Soaker Tester.

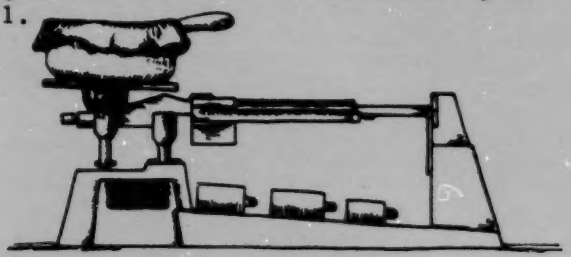
3. Take the sample of sphagnum moss. Put it in your Soaker Tester. Carefully weigh the whole thing (Soaker Tester with moss). Write down the weight in space #1 on Data Sheet 1 found in Activity Packet #7.



4. Add water to the bowl until it is nearly full. Let the Soaker Tester and moss sit in the water for 5 minutes.

5. Take the sieve out of the bowl. Pour the water out. Some water may drop out of the sieve for a few seconds. But do NOT squeeze any water from the moss or the sieve.

6. Put the sieve back in the bowl. Weigh the Soaker Tester and moss again. Write down the answer in space #2 on Data Sheet 1.



7. Repeat steps 3-6 using each of the other materials listed in Step 1 above. Write down the weights you find in the proper spaces on Data Sheet 1.

8. What is the weight of water each material soaked up? Find out by subtracting the number in column A from the number in Column B. Write the result in Column C.

9. Calculate the percentage of water in each material. The way to do that is shown in column D of Data Sheet 1.

10. What does this have to do with flood control? Activity Sheet 7-1 will help you answer that question. Take out that sheet and try to solve the puzzle you find there. You can write your answers on Data Sheet 2.

SUMMARY QUESTIONS

1. Which material that you tested holds water best?

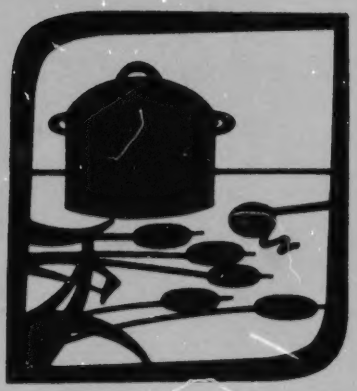
2. From your experience in this activity, what is one way wetlands help control floods?

3. Suppose you lived in Jestertown. You hear that Holsum City is building dikes on the Snake River (Drawing #2). Would that make any difference to you? Why or why not?

GOING FURTHER

Find out about flooding problems in your community. Is there a river or stream that runs through your area? Are there wetlands around the river? Have any wetlands around your area been filled? Are there more floods now than there were 100 years ago? Fewer floods? You should be able to get most of the information you need from engineers in the local government.

When you answer these questions, you should be able to write a history of flooding in your own area. You will be able to show how wetlands have or have not helped with this problem. Perhaps you can make an illustrated history of the area like the one shown in Drawings 1-3 on the Activity card.



8 Wetlands Dinner

OBJECTIVE

Suppose you had lived in a swamp 100 years ago. Where would your food have come from? There were no grocery stores. People ate the food they found around them. This activity contains recipes that use wetland foods. You can use the recipes to make a Wetland Dinner. Then share the dinner with classmates and friends.

MENU DU JOUR

Cattail Soup	Fried Catfish
Duck Potatoes	Chufa Bread

BACKGROUND

When was the last time you ate a meal like that? Probably never! Our eating habits have changed a lot over the last hundred years. Your great-grandparents ate foods that grew close to home. The fields and woods, rivers and ponds, and their own gardens provided most of what they needed. Today we seldom see the place from which your food comes. It is grown, cooked, and packaged far from where we live.

Sometimes we are reminded of natural foods around us. Have you ever had dandelion greens or nasturtium leaves in a salad? The wetlands in your community are a good source of natural foods. In many cases, these foods are more nutritious than those found in stores. They often collect lots of vitamins and minerals from

the wetlands in which they grow. (Can you guess why that is?) In this activity you'll prepare a meal using plants from the wetlands. They are plants you may never have eaten before.

There are a few important rules to keep in mind:

1. Be very sure that you know the plant you use. It is easy to get plants confused. Your teacher should check anything you cook. Be sure it's correct.

2. Always wash your plant-foods carefully. If you find them in a wild area they may be safe. But pesticides might have been used in the area. So it's better to wash them well.

3. Try to collect plants at just the right time. We'll tell you what that time is in the recipes. Otherwise a plant may not taste just right. For example, some plants taste bitter if they're picked too soon or too late. Bad taste can sometimes be removed by boiling the plant first. But it will be easier if you can pick the plant at the proper time.

THE ACTIVITY

1. Activity Packet #8 contains a number of recipes using wetland plants. Look through those recipes. Find three or four from which to make a wetland dinner. Keep in mind plants that grow in your area. They will be easiest to collect.

2. Next, collect the plants and other ingredients needed. Your class may organize a field trup to collect those plants. Or individual students may find them. Some special cautions are needed here. First, be sure you do not collect rare or endangered plants. Second, watch out for plants that are poisonous. This would be a good time to ask for expert help. Perhaps you can find a botanist to assist you. Or someone from the local museum might be able to help.

3. Finally, decide where you will cook and serve your dinner. You may be able to do this in your classroom. Or you might use the school kitchen or someone's home. You can invite guests to your dinner. But if you do, you will have to increase the amount of each ingredient.

4. Most of the recipes use unusual plants. But wetlands contain familiar foods, too. Look for some suggestions at the end of the recipe book. You may want to also include these items.

5. People from other countries often have interesting wetland recipes. Sunomono (in the recipe book) is a Japanese dish, for example. You may want to invite someone who knows about Japanese, Chinese, or some other kind of international cooking.

SUMMARY QUESTIONS

1. What new things did you learn about the wetland organisms you used in this activity?

2. Did you enjoy making a wetland dinner? Why or why not?

3. Are foods that grow naturally (in wetlands or the forest, for example) better for you than those grown on the farm? How do you know? How could you find out if you don't know?

GOING FURTHER

1. You could prepare a wetland dinner for others: another class in your school, your parents, or your friends. There are things you can do to make your dinner more interesting. For example:

   a. Draw and color pictures that show the plants you used in your meal.

   b. Make a booklet that tells about each of the plants used in the meal.

2. Wetland plants have been used as food by Native Americans and other wetland dwellers for centuries. See what you can find out about this in one of the books listed below.

   a. Bradford Angier. Field Guide to Edible Wild Plants. Stackpole Books. 1975.

   b. B. Brackett and M. Lash. The Wild Gourmet: A Forager's Guide to the Finding and Cooking of Wild Foods. David R. Godine, Publisher. 1975.

   c. Charlotte Bringle Clarke. Edible and Useful Plants of California. University of California Press. 1977.

   d. Adrienne Crowhurst. The Weed Cookbook. Lancer Books. 1972.

e. W. C. Grimm. Indian Harvests. McGraw-Hill Book Company. 1973.

f. Zack Hanle. Cooking with Flowers. Price/Stern/Sloan. 1971.

g. Ben C. Harris. Eat the Weeds. Barre Publishers. 1972.

h. Mary MacNicol. Flower Cookery. Collier Books. 1972.

i. Alan McPherson. Wild Food Plants of Indiana and Adjacent States. Indiana University Press. 1977.

j. Oliver P. Medsger. Edible Wild Plants. Collier Plants. 1972.

k. Lee Peterson and Roger Tory Peterson. A Field Guide to Edible Wild Plants of Eastern and Central North America. Houghton Mifflin. 1978.

l. A. M. Steward and Leio Kronoff. Eating from the Wild. Collier Books. 1972.

9 Wetland Arts and Crafts

OBJECTIVE

What can you make from a cattail? You could make something useful: a hat or a table-mat, for example. Or you could make something that is pretty: a woven wall hanging, perhaps. In this activity you will learn how to make some crafts (useful things) and some art (expressive things) from wetland materials.

BACKGROUND

Arts and crafts projects are a good way to learn more about wetland organisms. You'll have a chance to work with cattails, ferns, reeds, and other plants and animals found in wetlands. The activities should help you to learn about these organisms. But there's more than just learning about plants and animals in the activities. You will be making some useful objects. Or you'll be creating new works of art. When you've finished the activities, you'll have skills you didn't have before.

The directions in these activities are not the only way of doing things. They are just suggestions. You may think of better ways to do each project. Your own imagination is very important. Be creative!

There are probably more activities here than you can do. Your work will be limited by the materials you can find. Before you begin, look through all the

activities. Compare them with the wetland materials in your area. Then decide which ones you can do.

TEH ACTIVITIES

The directions for seven arts and crafts projects are contained in the booklet in Activity Packet #9. Look through the booklet. Decide which activities you want to do. Then make a trip to your local wetland. Cellect the plants and animals you need.

Use special care in your collecting. Be a friend to the wetlands! They have enough trouble with humans. Don't be a pest! If you need one cattail, don't pull up twenty. If you want one leaf, don't tear up a whole plant. Use good judgment as you collect.

Now look at the Activity Booklet in Activity Packet #9.

SUMMARY QUESTIONS

1. What did you learn about wetland organisms by doing this activity?

2. Which activity did you enjoy doing most? Why?

3. Imagine that you had lived in a wetland 100 years ago. What are some of the things that you might have made from wetland materials? Think of things other than those described in this activity.

GOING FURTHER

A Wetland Arts and Crafts Show would be a good way to conclude this activity. The things made by members of the class can be set up in your classroom. Then other classes could be invited to visit your display. Parents and friends will also want to see what you have made.

10 Human Life in the Wetlands

OBJECTIVES

Many organisms live in wetlands. Among them is Homo sapiens: the human being. In this activity you'll read about some humans who have made their home in wetlands, past and present. You'll see how wetland living is different today from what it was 100 years ago.

BACKGROUND

This activity is about two marsh families. One is a Creek Indian family that lived about 1850. The other is a modern day family. The families show us two different ways of looking at wetlands. The sketches below illustrate those two ways. Do you understand what the drawings say?

Humans are part of the environment. The things they do change the environment. The environment influences the way people live. For example, think of a city built on a river:

1. People use the river as a source of water. It can also be a means of transportation. Industries use river water in their plants. The river changes the way people lives.

2. But people change the river too. They may dump their garbage in the river. They make the river dirty with gasoline and oil from their boats. Factories may heat up the water they use. All of these changes affect the river and the plants and animals that live there.

Many changes were mentioned in (1) and (2). Which ones were "good"? Which ones were "bad"? Explain how you decided on your answer in each case. You can write your answers to this question on Data Sheet 1, found in Activity Packet #10.

In this activity you will read about two families who live on a marsh. You will try to decide:

1. How each family uses the marsh, and
2. How each family affects or changes the marsh.

THE ACTIVITY

1. Take our the Activity Sheets in Packet #10. Sheet 10-1 has a drawing of Cochin's house. Cochin was a Creek Indian girl who lives about 1850. Read the description below, of Cochin's way of life. Then read and answer the questions on Data Sheet 2.

Cochin's Family

Cochin's house was built in the middle of the Big Turtle Marsh. It was made of reeds, river grass, leaves, and other materials from the marsh. She and her family travelled in a birch bark canoe. They got almost all their food, cloth, tools, and toys from the marsh. Their diet consisted of marsh plants, fish, a few beavers, and large wading birds. The men of Cochin's tribe spent nearly all their time hunting and fishing. It was hard just to get enough food. The women harvested the plants and took care of the houses.

The sanitary habits of Cochin's family were simple. They dumped all of their wastes directly into the marsh. The water carried away most of the wastes. But some collected in large stagnant pools and caused health problems. Insects and other animals in the marsh also transmitted malaria and other diseases. There was a lot of illness in Cochin's tribe. Life was often difficult. Only about half the babies born lived to be more than a year old. Still, Cochin was very happy. She loved her home and her life on the marsh.

2. Activity Sheet 10-2 is a drawing of Angela's home. Angela lives on the edge of Big Turtle Marsh in the 1980's. Read the description of Angela's way of life. Then read and answer the question on Data Sheet 2.

Angela's home is a modern house. It is built on fill dirt. Large trucks and bulldozers created a plot of dry land on the shores of Big Turtle Marsh. Before, the land had been a typical soggy wetland. It was not firm enough to hold a modern cement and wood house. Angela goes to and from her home in a 1980 Chevy Chevette. The family also has an outboard motor boat for traveling on the marsh. Almost all of Angela's food comes from Marshville Shopping Center, 12 miles away. Angela has never heard of cattail soup, duck potatoes, or chufa bread. Angela's father works at a bank in Marshville. Her mother is a 6th grade teacher at Marshville Middle School. In his spare time, Angela's father likes to hunt and fish in the marsh. Angela's mother likes to garden. But she has a lot of problems with pests from the marsh. Mosquitoes make it hard to work outdoors. Other marsh insects eat her flowers. And muskrats have stolen most of her tulip bulbs. Spraying the marsh has helped with pests. A few muskrats have been caught in traps. But Angela's family is still annoyed by animals that creep out of the marsh to pester them. Still, Angela is very happy. She loves her home and her life on the marsh.

SUMMARY QUESTIONS

1. Was the marsh a good friend to Cochin's family? Why or why not?

Was the marsh a good friend to Angela's family? Why or why not?

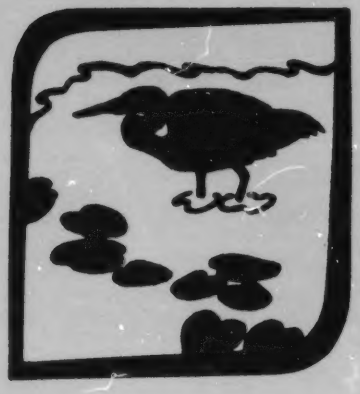
2. Was Cochin's family a good friend to the marsh? Why or why not?

Was Angela's family a good friend to the marsh? Why or why not?

3. Think of the way your family lives with nature. Are you good friends to the environment? Why or why not? (If you live near a wetland, answer this question for that wetland.)

GOING FURTHER

Write a short story, a play, or a poem about the life of a wetland family. You could choose either Cochin's or Angela's family for your story. The story, play, or poem should show why either girl's family is a friend or an enemy of the wetlands.



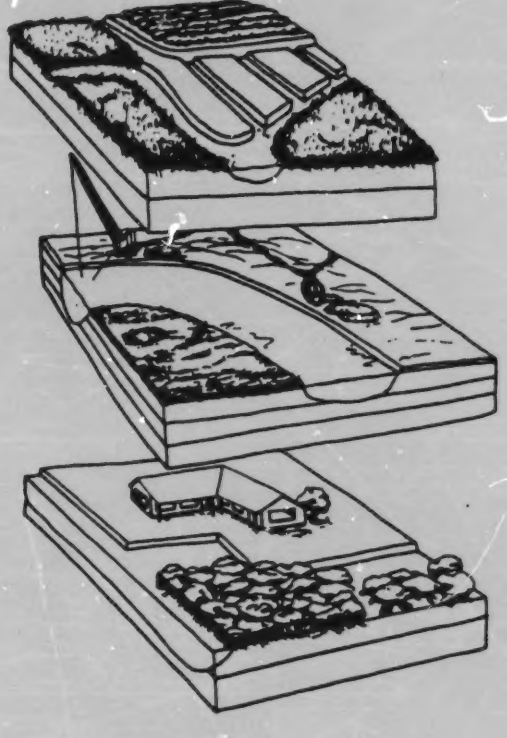
11 Endangered Wetlands

OBJECTIVE

Wetlands are often changed by humans. They are drained, covered up, or damaged in other ways. There may be a wetland in your own community like that. This lesson is about that wetland. You will find out why some people want to change this wetland. You will learn how these changes can be made. And you will think about the advantages and disadvantages of these changes. You'll learn that some people do not want to change the wetland. Along the way you'll learn how to find wetland experts in your community.

BACKGROUND

What do all of the following pictures have in common?



In each example, humans are changing wetlands into dry lands. The farmer is draining a swamp to get more land for crops. The engineer is dredging a coastal area. That will make a deeper port for ships. The builder is filling in a salt marsh. Then there will be land for home building. To each of these people, the wet land is more useful dry than it was as a natural wetland.

So what's wrong with that? We need more land to grow food on. Ships must dock. People want houses built on the water-front. Each project seems worth doing. But other people think that wetlands should be left the way they are. They object to the activities shown in these pictures. Wetlands are worth preserving, they say, for many reasons:

1) They serve as homes and feeding grounds for fish, birds, and other organisms.

2) They help protect areas against flooding.

3) They are beautiful areas that should be protected. People can enjoy them in the future.

There is probably a wetland area in your community that some people would like to change. For this activity you should find out about this area. One way to do that is to find a wetland expert who will visit your class and tell about the area.

THE ACTIVITY

There are four steps in this activity:

1. Choose a wetland in your community to study. It should be one that some people want to change. It might be a swamp someone wants to drain for farmland. It could be a marsh where someone wants to build a shopping center. Or it could be a bog that will have to be covered for a new road.

2. Look for someone who knows about this wetland. Ask that person to speak to your class. In fact, you may want to find two speakers. One person could tell why the wetland should be changed. The other could tell why it should be kept in its natural state. Some ideas for finding guest speakers are given on Activity 11-1 in Activity Packet #11.

3. Arrange for the speaker's visit. Decide what questions to ask them. Some ideas for questions are found in Activity Sheet 11-2 in the envelope.

4. Summarize the things you've learned from your guest's visit. Here are three ideas:

   a. Make a bumper sticker about the wetland. A blank bumper sticker for you to work with is included in Envelope #11. Let the bumper sticker say how you feel about using the wetland. Create a clever saying and design. Use crayons or paints to make the finished bumper sticker.

   b. Design a T-shirt. Invent a slogan that shows what you think about using this wetland. Your art teacher may help to make a pattern. Perhaps you can silk-screen T-shirts for the whole class.

SUMMARY QUESTIONS

1. In what ways are wetlands important to your community?

2. What are some things that people in your community do to harm or preserve wetlands?

3. What kinds of laws do you think your community ought to have about the use of wetlands?

GOING FURTHER

1. Create a radio, television, or newspaper advertisement. It should share with other people the things you've learned in this activity. One of your local stations or newspapers may be willing to carry your message.

2. Write a letter to your local newspaper, local industries, city or county government, or other interested groups about the wetland you studied. Ask for a reply to your letter. That way you'll know how these groups feel about the endangered wetland.

12

What do you think about the wetlands?

OBJECTIVE

In this activity you will have a chance to find out how people feel about wetlands. You'll find out how they feel about what is or is not happening to the wetlands. To find out you will conduct a survey.

BACKGROUND

People are different in many ways. People look different, of course. But they also differ in how much they know about a subject. They differ in how interested they are in various subjects. And they differ in what they think is important or valuable in a subject.

People think differently about wetlands, also. Some people have no knowledge of wetlands. Others are well informed. Some believe our wetlands should be saved at all costs. Others would be pleased to drain,

fill, or flood all of our wetlands for farms, homes, or other construction. And others may not care.

To find out how people feel about a subject you can conduct a survey. Suppose an electric company had to increase the amount of electricity it produced. The easiest way for the company to do it might be to raise the height of the dam. Before going too far with the project, it might be wise for them to conduct a survey. In this way they could find out how people feel about the flooding of more lands behind the dam. The information may help the company decide what to do next.

THE ACTIVITY

Find a partner and remove the 10 flash cards and the data sheet from Activity Packet #12.

You and your partner should plan to interview 20 people: 5 men, 5 women, 5 boys, and 5 girls. But the more you interview, the better.

When you interview someone, one of you should present the flash cards. The other should write the answers of the person being interviewed.

Suppose your first interview is with a man. Use the data sheet marked MEN. Now hold up flash card #1 and ask the man, "How do you feel about this?" Tell him to answer "good" or "so-so" or "bad". If the answer is "good" write a "2" in the first space. Write a "1" for "so-so" and a "0" for "bad".

SUMMARY QUESTIONS

1. How differently did the men, women, boys, and girls interviewed react to the wetland cards?

2. If there were differences in their responses, how can you explain them?

3. Besides responding "good," "so-so", and "bad", what other comments did the people you interviewed make?

GOING FURTHER

1. Suppose you interviewed 10 or 20 persons in each of the four groups. How different do you predict their total response will be?

2. Invent another way to find out what people know or how people feel, about the wetlands.

Glossary

Adaptable	To be flexible and conform with surrounding changes.
Bacteria	Single-celled microorganisms without nuclei in their cells.
Cell	The fundamental unit of life of which all organisms are made.
Detritus	Organic matter resulting from decaying plants or animals.
Dike	A dam or embankment used to prevent flooding by the sea or by a stream.
Ecology	The study of organisms as they interact with each other and with everything around them.
Endangered	Species whose habitats, food sources, and lives are in danger of destruction by human activity.
Environment	All the living and non-living surroundings of an organism.
Extinction	The death of a kind of organism.
Food chain	The flow of energy and materials through a sequence of organisms, starting with plants and including plant eaters, meat eaters and decomposers.
Food web	The exchange of nutrients and energy among a network of organisms in a community.
Germinate	To develop; to sprout; to begin to grow.
Invertebrates	Any animal without a backbone.
Larva	A growth stage, in some animals, which does not look like the adult form.
Mammal	Animals, with backbones, hair and glands with which females produce milk for their young.
Pesticides	Substances used to kill or control undesirable plant or animal life.
Pith	The spongy tissue in the center of certain plant stems.
Photosynthesis	The process by which plants change the energy of sunlight into food energy.

Phytoplankton	Microscopic plants, capable of photosynthesis, found floating in oceans and lakes.
Pupa	A growth stage, in some animals, which occurs between the larva and adult forms.
Specimen	An object of interest and study.
Tuber	A short, thick, underground stem, often bearing minute buds or eyes.
Savannahs	Grasslands in tropical and subtropical regions containing scattered trees and shrubs.
Submergent plants	Plants whose roots and leaves are under water.
Wetland	An area in which the ground is saturated by water at least part of the year and characterized by plant life suited to water-logged soil.
Zooplankton	Microscopic animals swimming or floating near the surface in oceans and lakes.

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ACTIVITY PACKETS

Chapter 1 - An Introduction to Wetlands - None

Chapter 2 - Make a Wetlands Environment
- freshwater marsh(fw2-1 to fw2-22)
- saltwater marsh(sm2-1 to sm2-19)
- swamp(s2-1 to s2-11)
- bog(b2-1 to b2-9)

Chapter 3 - The Field Trip
- field trip task cards 1-12

Chapter 4 - Food Webs in Wetlands
- food web game cards 4-1 to 4-16

Chapter 5 - Study of a Wetland Organism
- instruction sheets 5-1 to 5-8

Chapter 6 - Identifying Wetland Plants and Animals
- flash cards 6-1 to 6-11

Chapter 7 - Wet Lands in the Wetlands
- data sheets 1 and 2
- activity sheet 7-1

Chapter 8 - Wetland Dinner
- eight wetland recipes

Chapter 9 - Wetland Arts and Crafts
- activity sheets 9-1 to 9-12

Chapter 10- Human Life in the Wetlands
- data sheets 1 and 2
- diagrams 1 and 2

Chapter 11- Endangered Wetlands
- activity sheet 11-1 and 11-2

Chapter 12- What do you Think About the Wetlands?
- large flash cards

No Activity Sheets For This Chapter

Make a Wetlands Environment

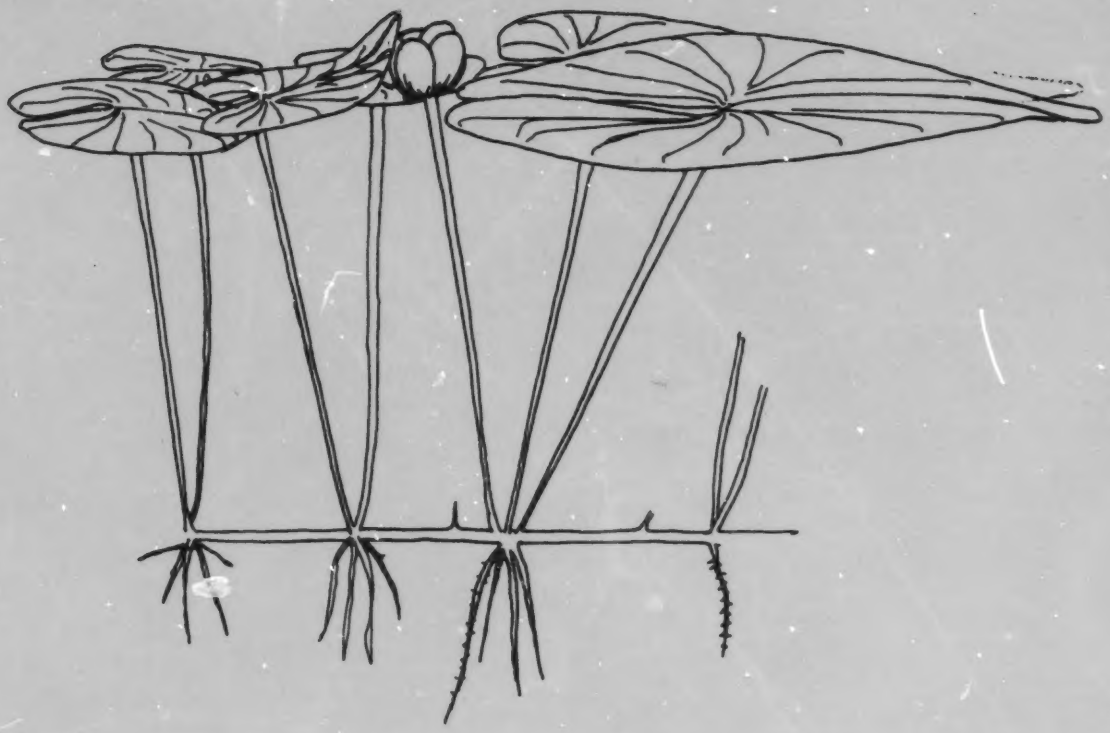
Chapter 2
Activity Sheets

ARROWHEAD

fw2-1

RED-WINGED BLACKBIRD

fw2-2



WATER LILY

BROAD-LEAVED CATTAIL

Fw 2-4

MALLARD

FW2-G

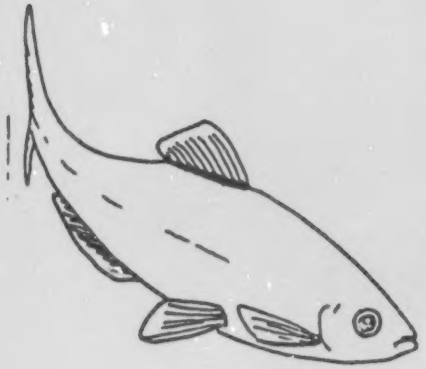
MARSH HARE

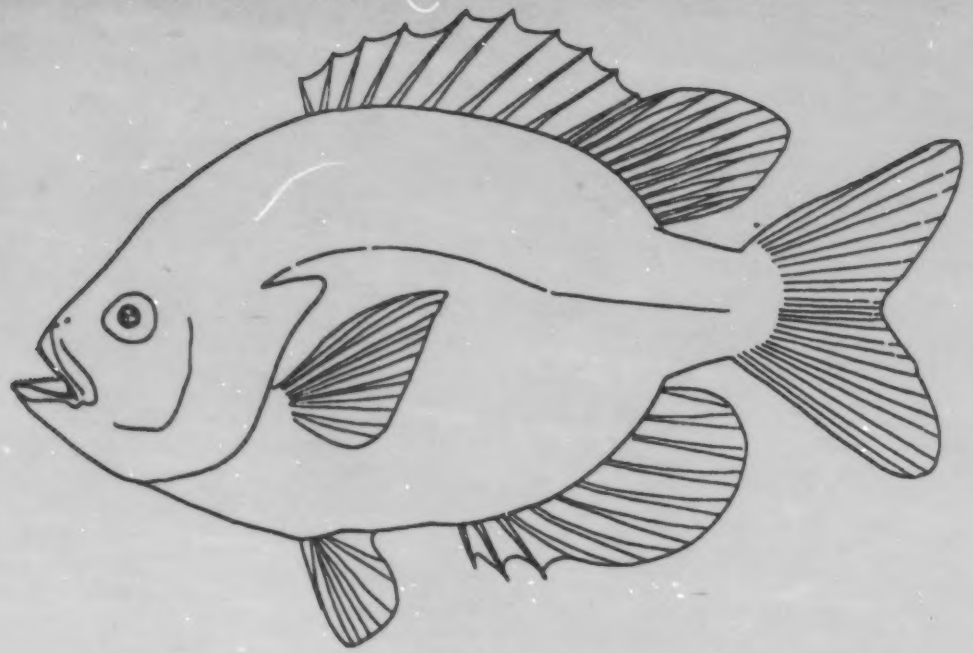
SANDHILL CRANE

fw2-7

fw 2-8

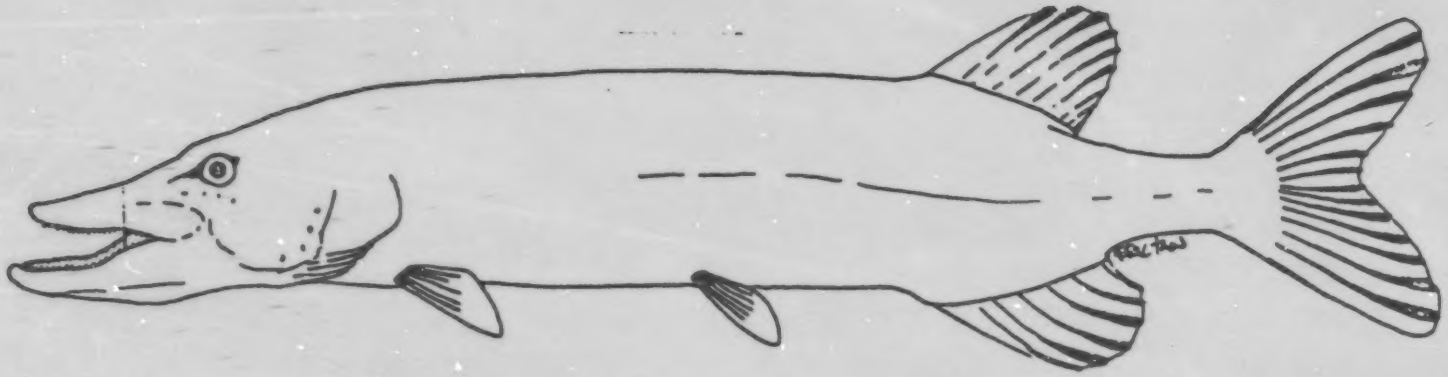
MINNOWS





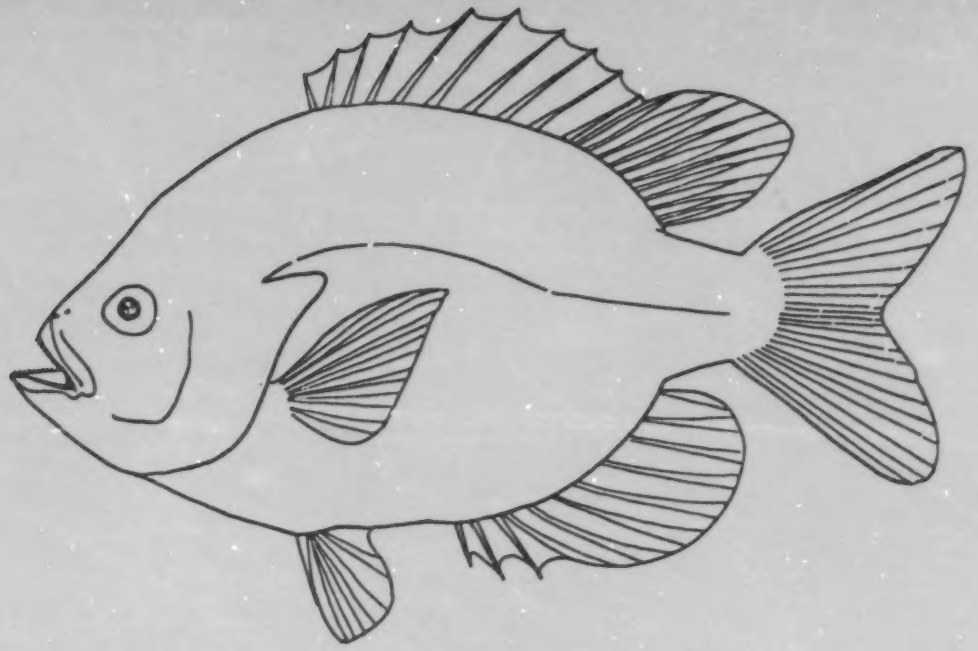
SUNFISH

Fw 2-9



PIKE

fw 2-10



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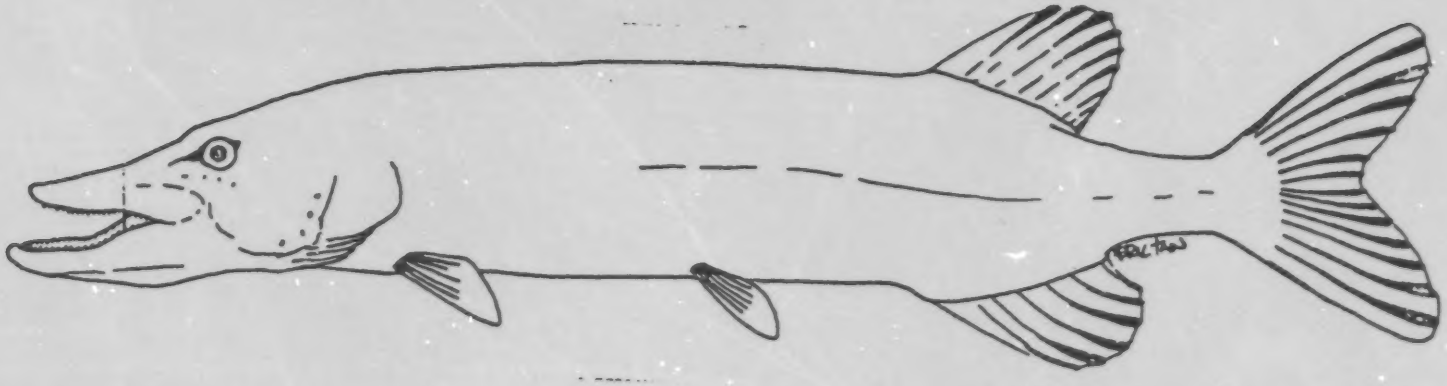
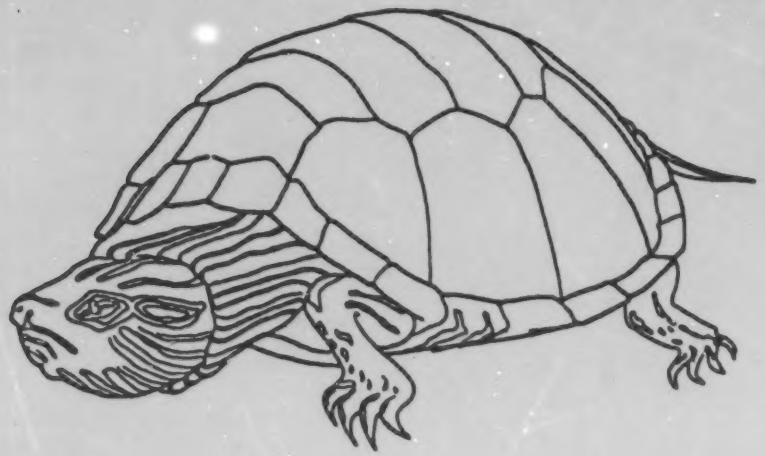


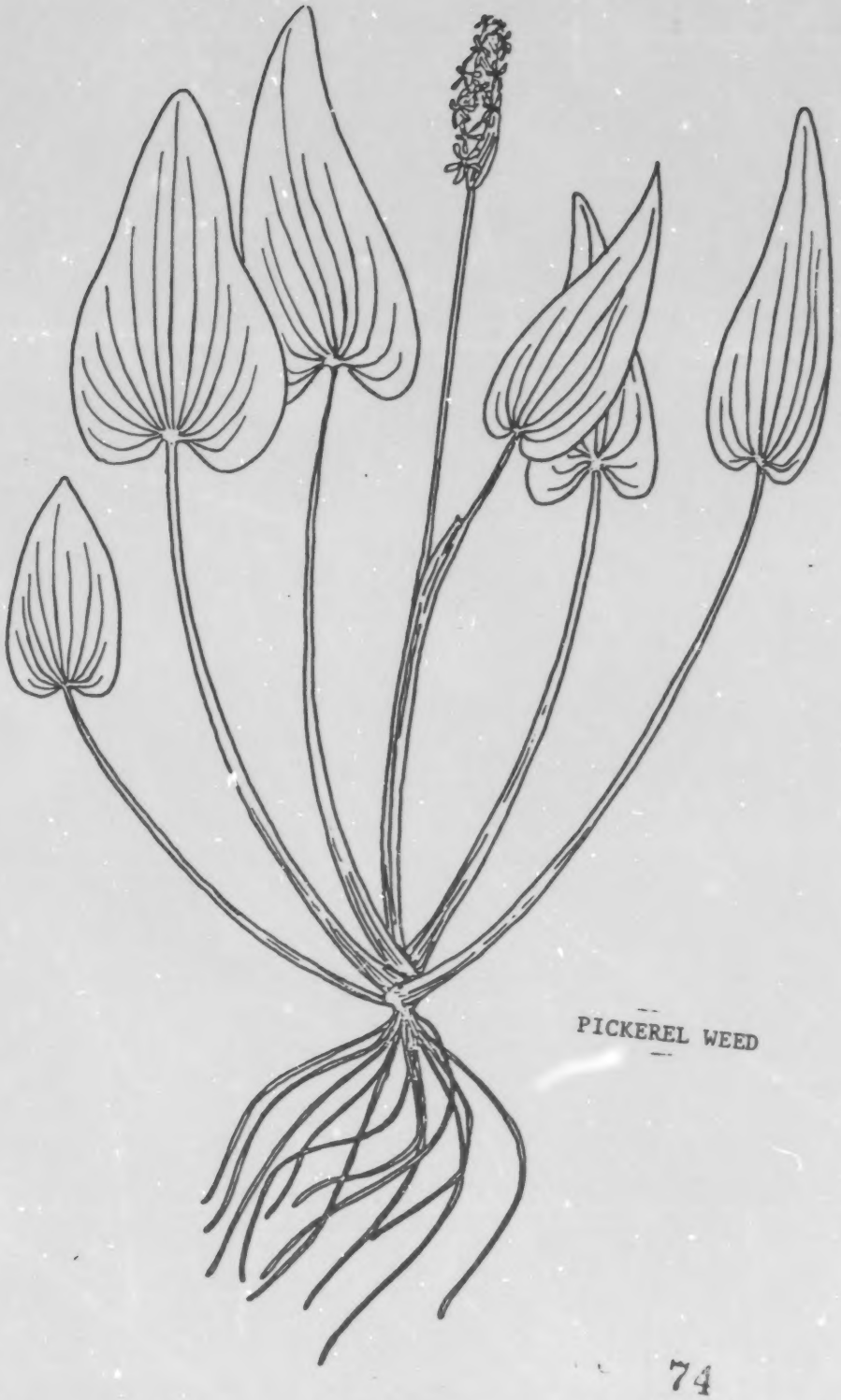
PIKE

fw 2-11



PAINTED TURTLE

BULLFROG



PICKEREL WEED

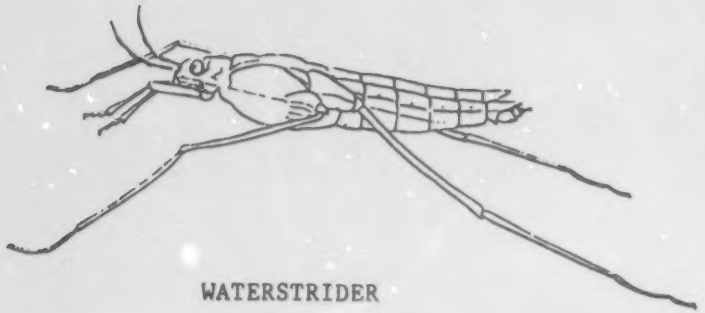
FW 2-13

MUSKRAT

fw 2-14

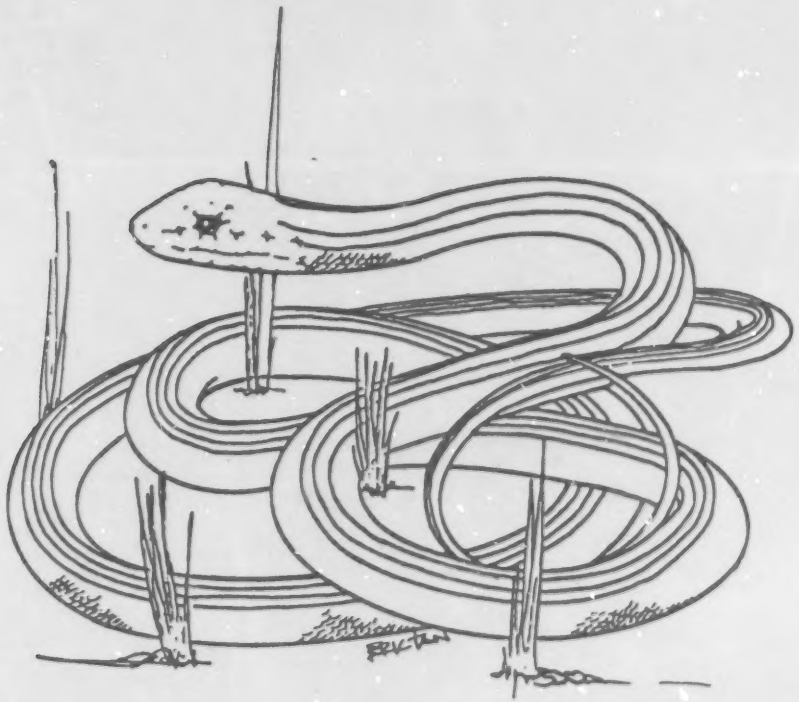
MINK

WHIRLIGIG BEETLE



WATERSTRIDER

fw 2-15



COMMON GARTER SNAKE

RACCOON

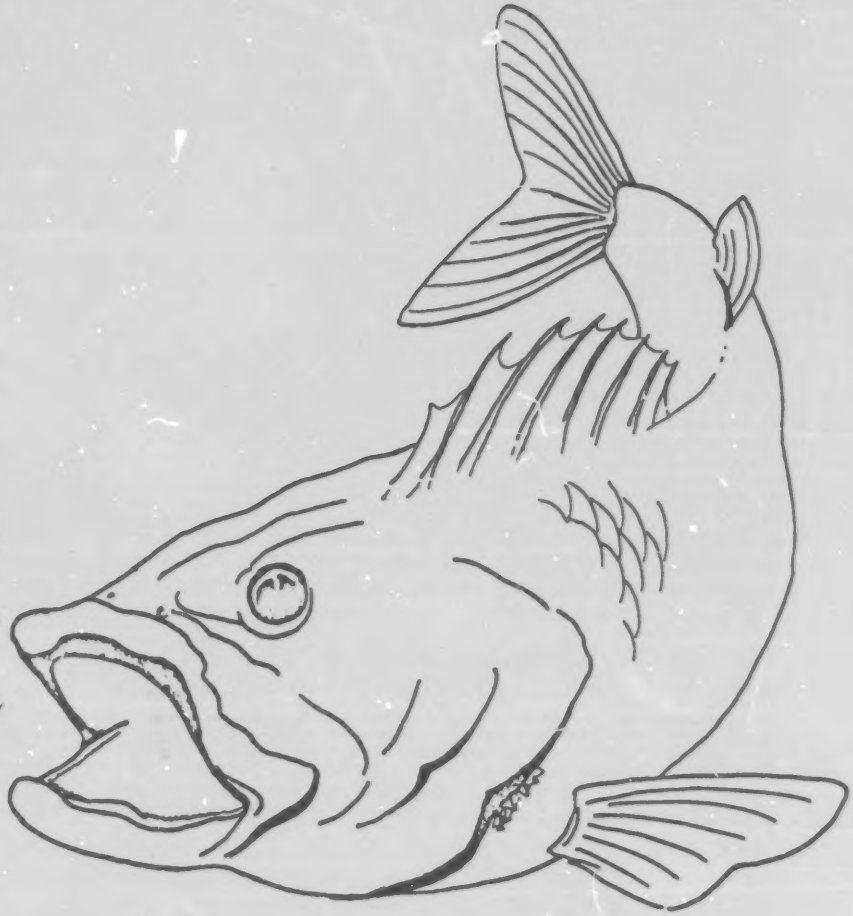
fw 2-17

LONG BILLED MARSH WREN

81

MARSH HAWK

82

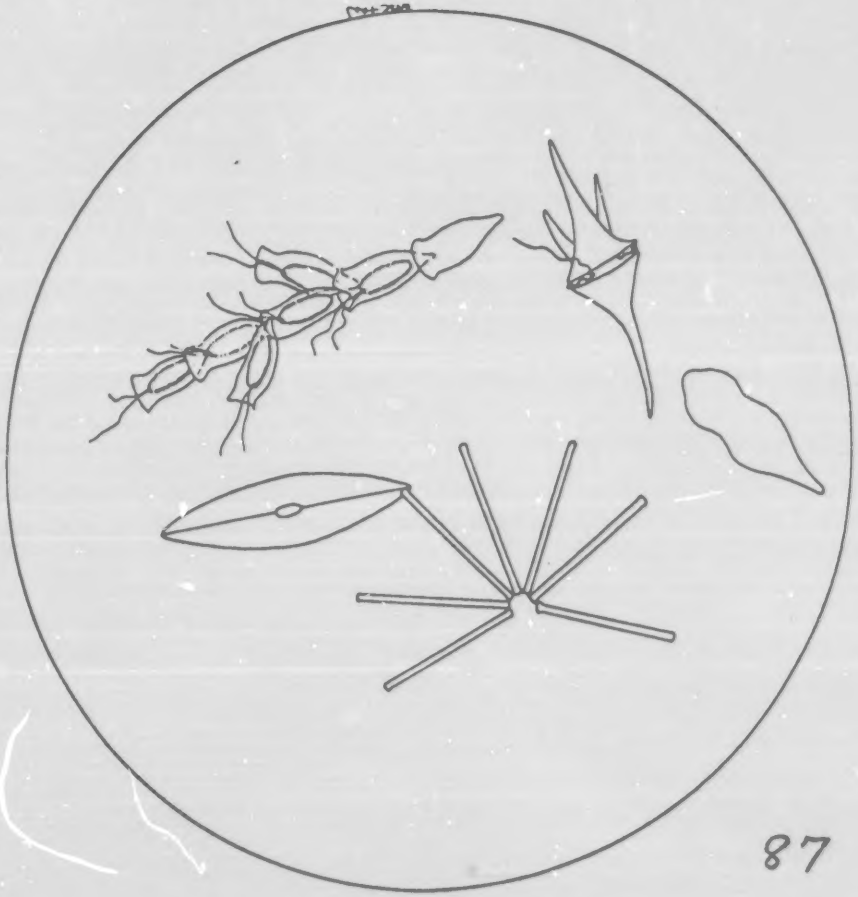


FW 2-18

LARGE-MOUTHED BASS

fw 2-19

BEAVER



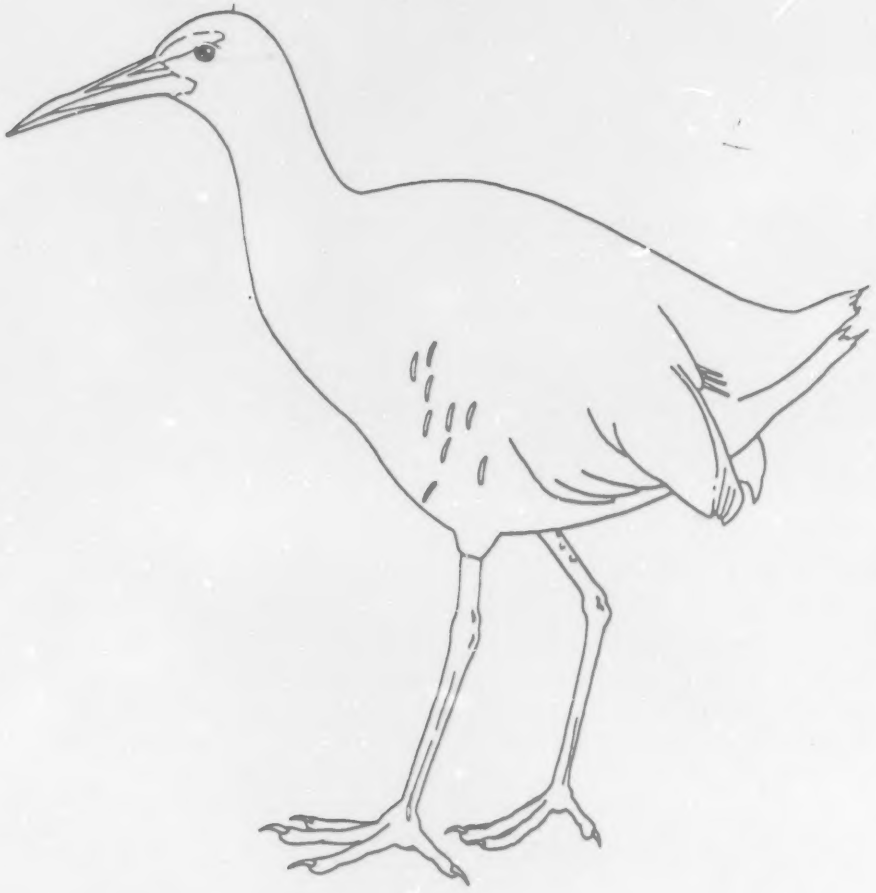
Fw 2-20

PHYTOPLANKTON

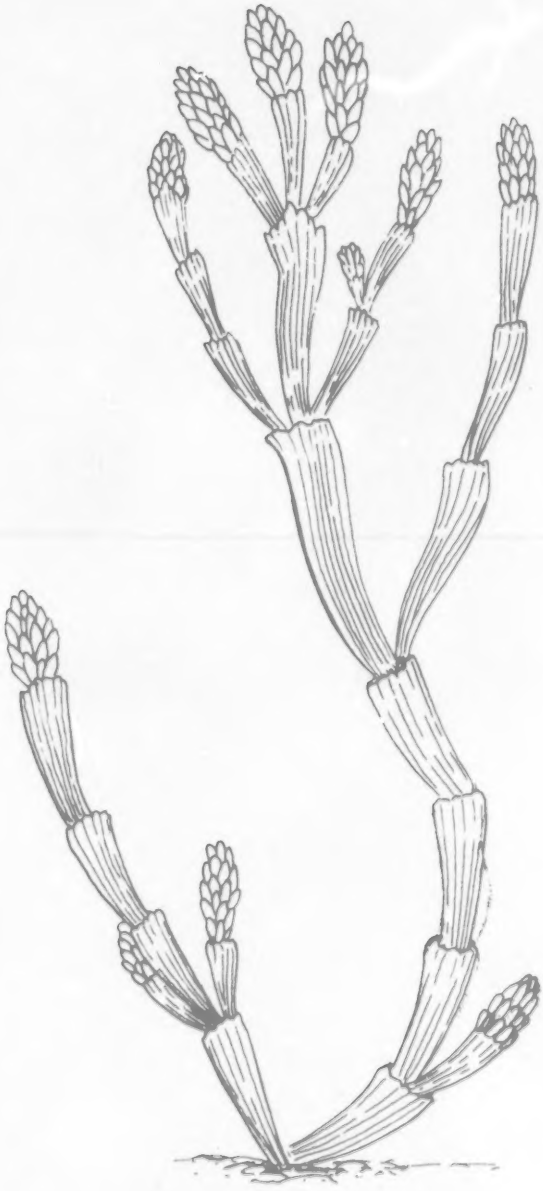
NARROW LEAVED CATTAIL

fw2-22

WOOD DUCKS



CLAPPER RAIL



GLASSWORT

REED

Sm 2-3

SEDGE

LAKE SEDGE

LAKE SEDGE

sm 2-6

SWITCH GRASS

Sm2-7

SWITCH GRASS

sm2-8

SWITCH GRASS

Sm 2-9

SWITCH GRASS

sm 2-10

REED

101

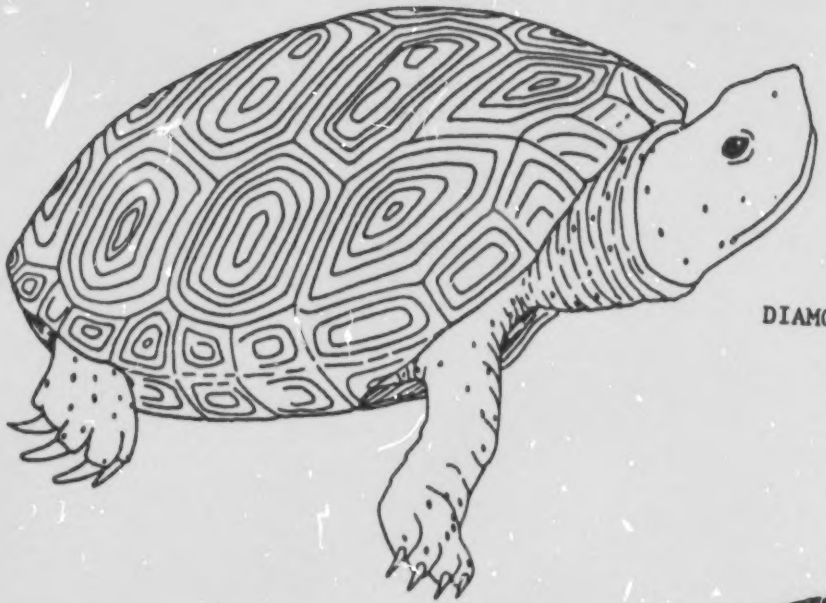
Sm 2-11

SEDGE

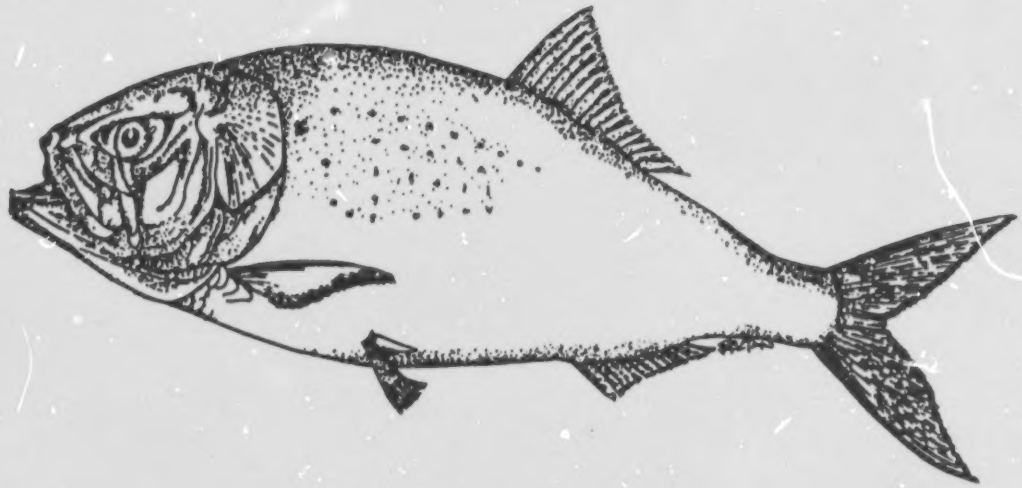
Sm 2-12

OSPREY

Sm 2-13



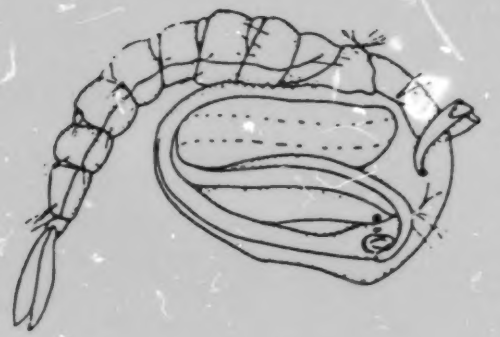
DIAMOND BACK TERRAPIN



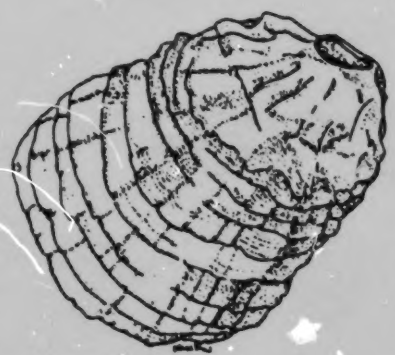
MENHADEN

SM 2-14

SALT MARSH MOSQUITO



MOSQUITO PUPA



EASTERN OYSTER

SM 2-15

BLUE CRAB

Sm 2-16

CAROLINA MARSH CLAM

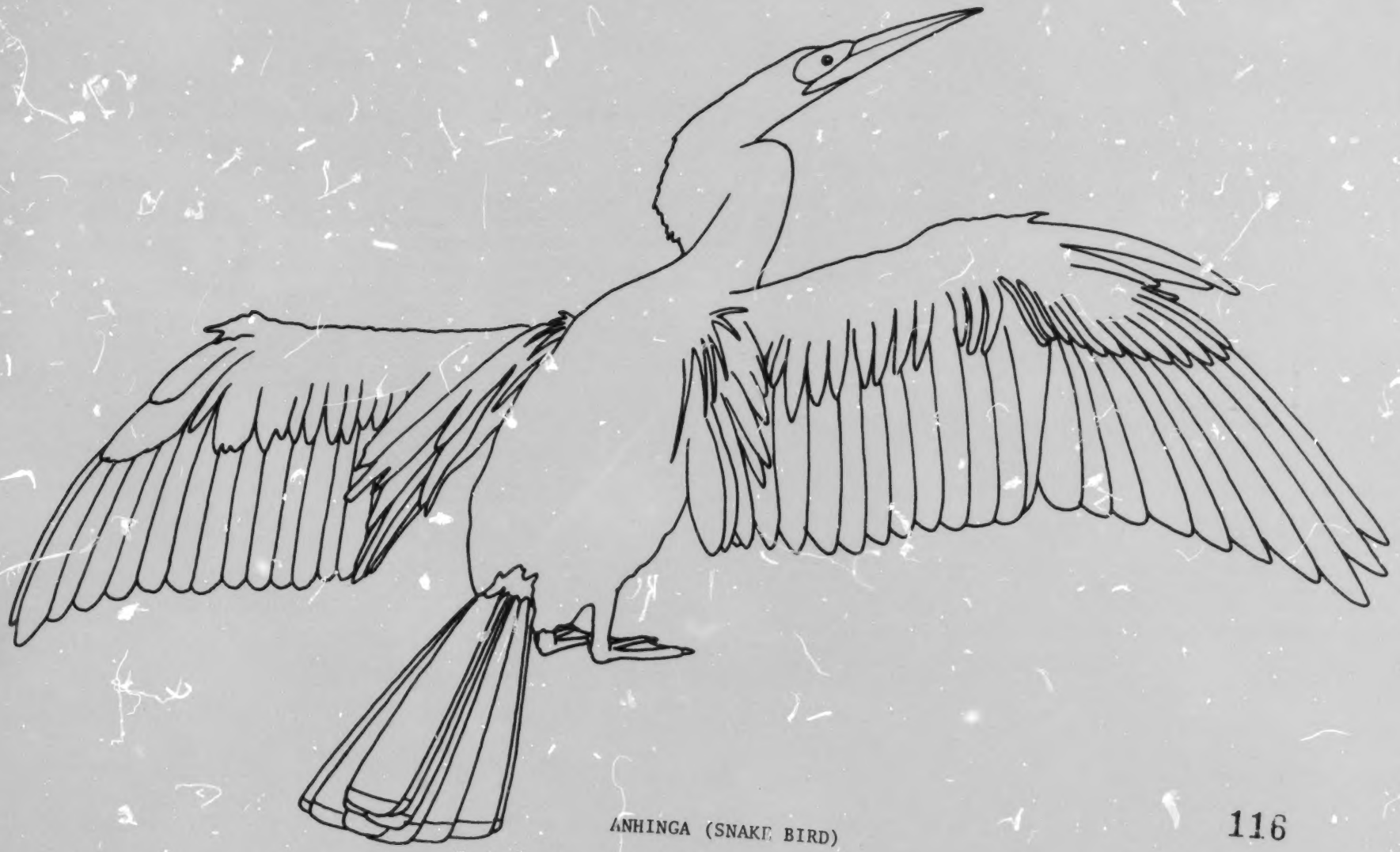
GREAT BLUE HERON

SALT MARSH PERIWINKLE

RIBBED MUSSEL

MARSH FIDDLER CRAB

DRAGON FLY



S2-2

ANHINGA (SNAKE BIRD)

115

116

IVORY-BILLED WOODPECKER

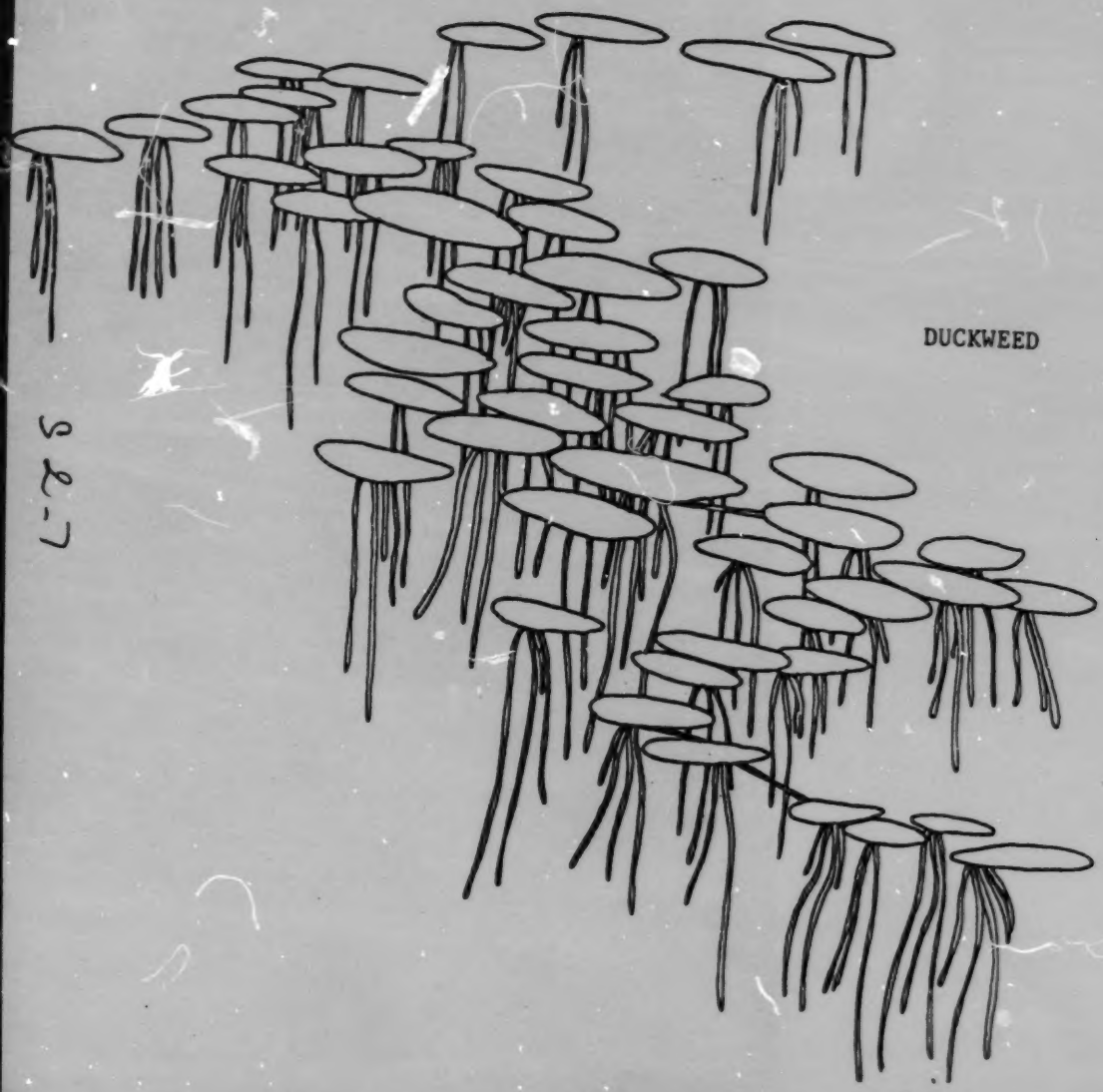
S2-4

GREEN TREE FROG

BALD CYPRESS S2-5

S2-6

AMERICAN ALLIGATOR



DUCKWEED

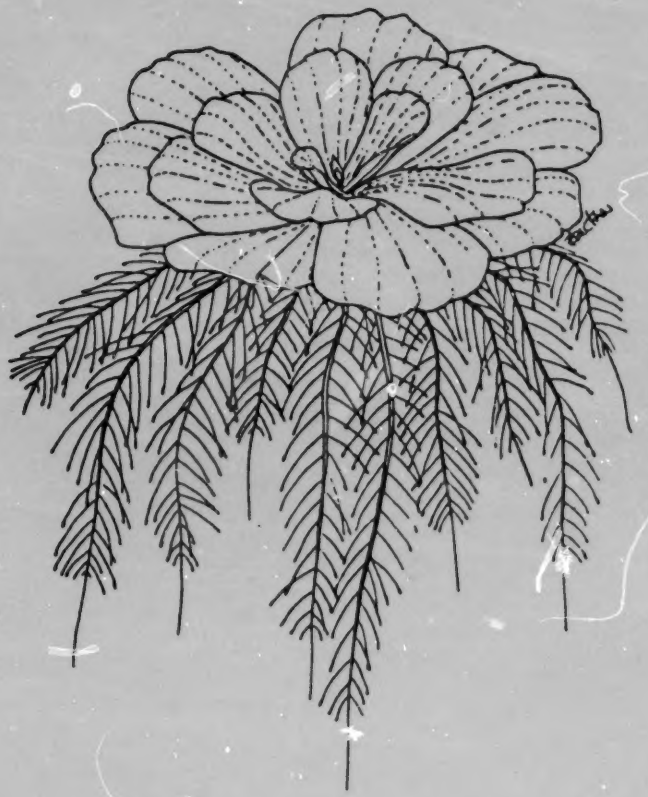
L-78

TUPELO TREE

S2-9

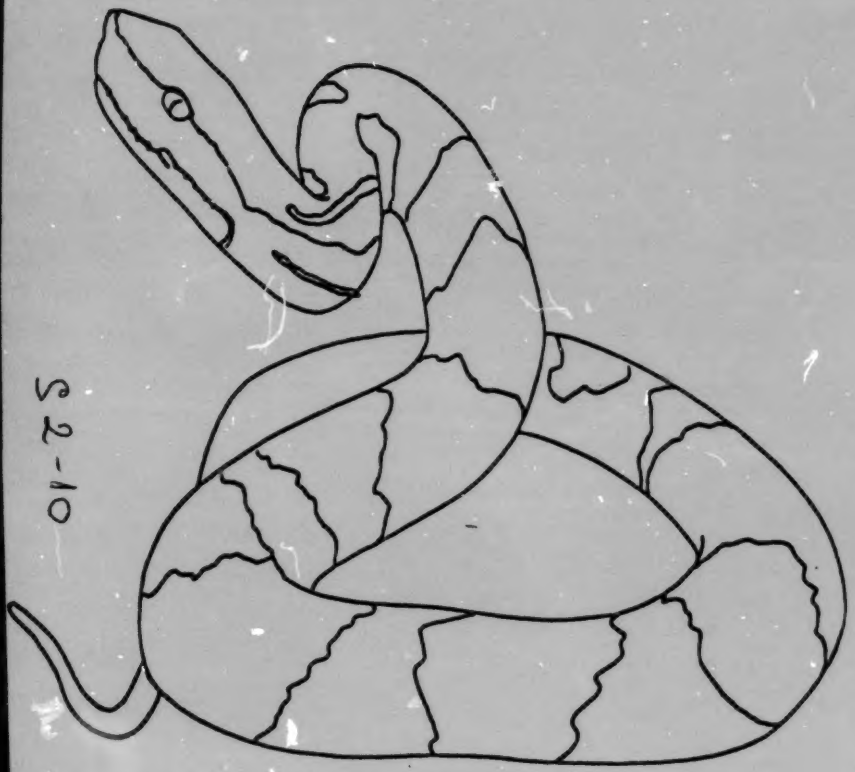
ARROW ARUM

124



WATER LETTUCE

125



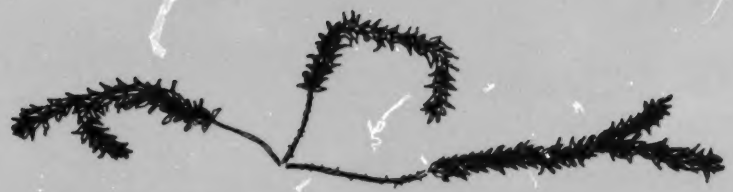
S2-10

COTTONMOUTH SNAKE

S 2-11

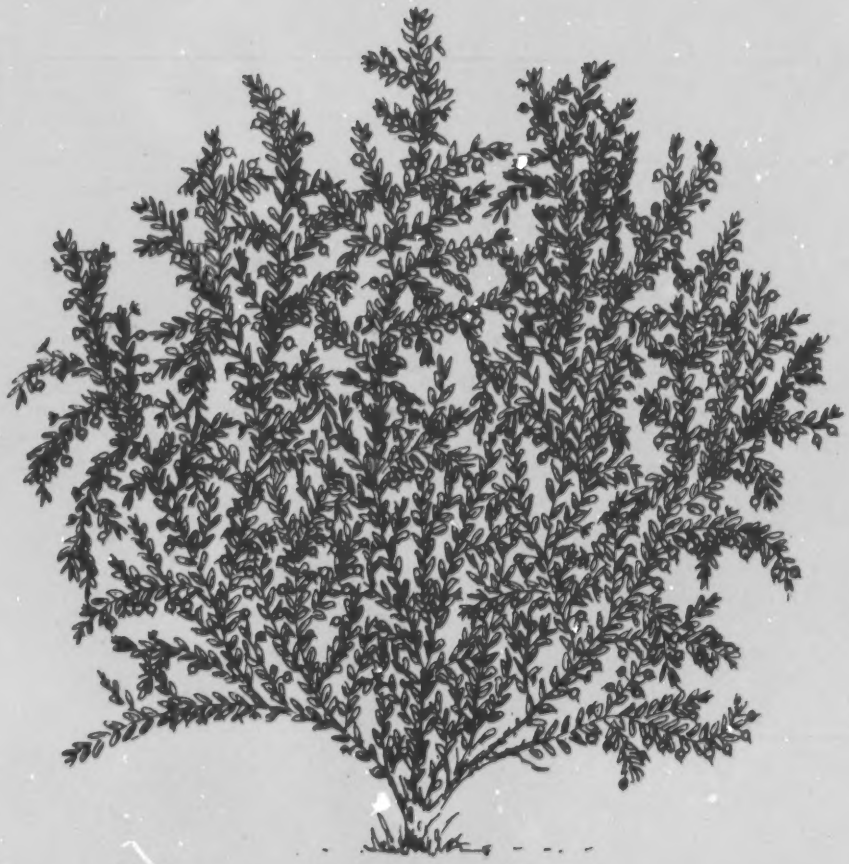
LIMPKIN

SPHAGNUM MOSS



b2-2

CRANBERRY

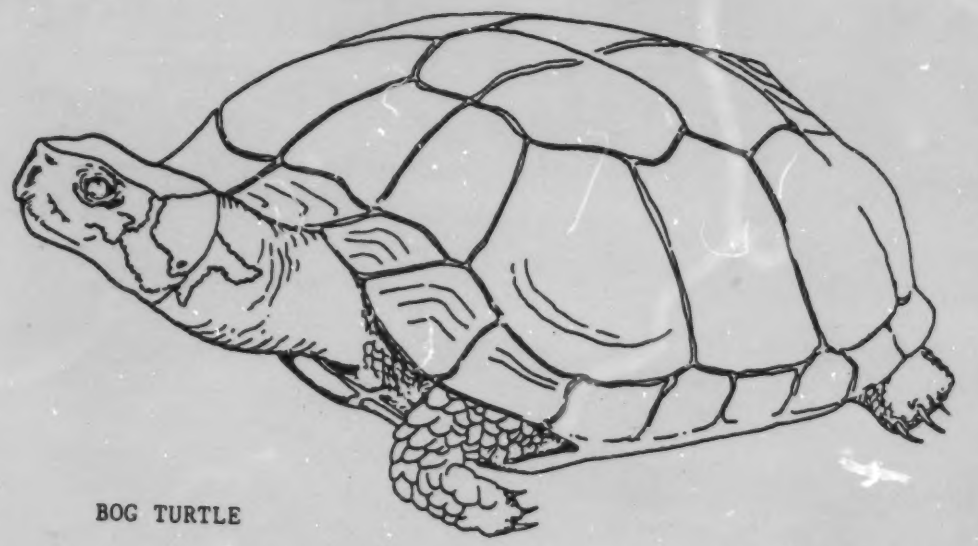


HIGH BUSH BLUEBERRY

COTTONGRASS

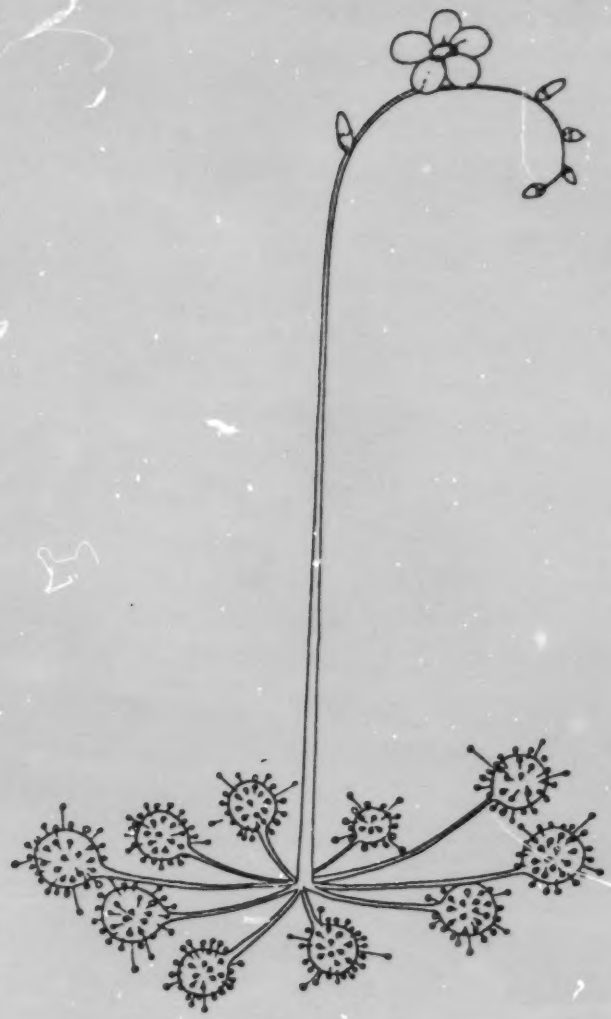
b2-4

BOG LEMMING



BOG TURTLE

b2-6

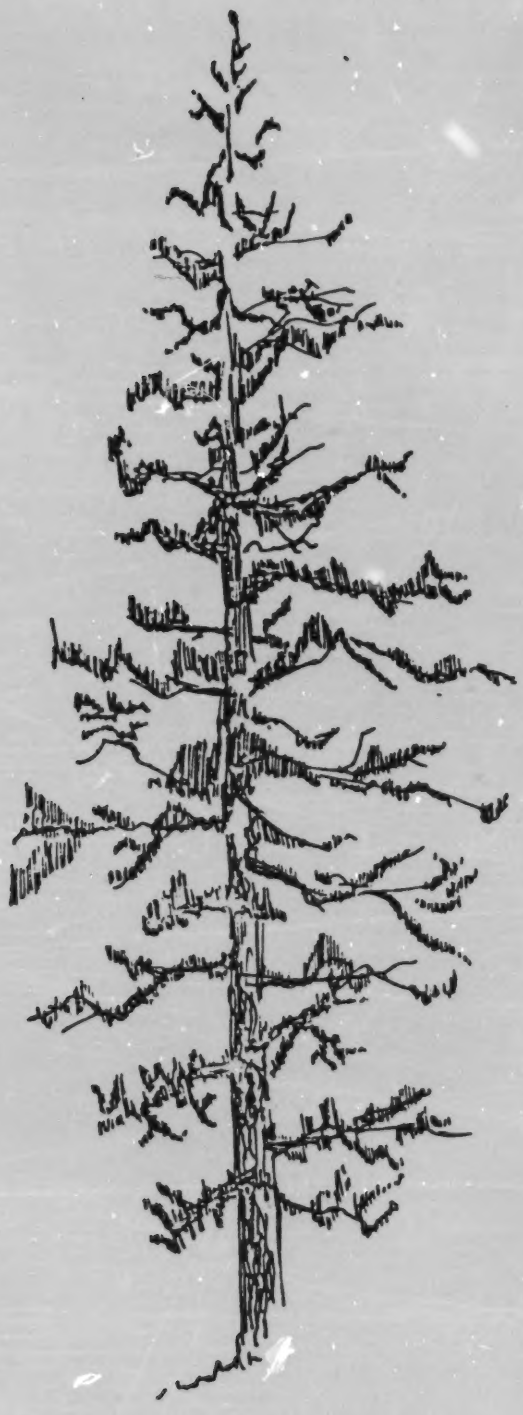


SUNDEW

136

PITCHER PLANT

137



AMERICAN LARCH

b2-7

b2-8

ARETHUSIA ORCHID

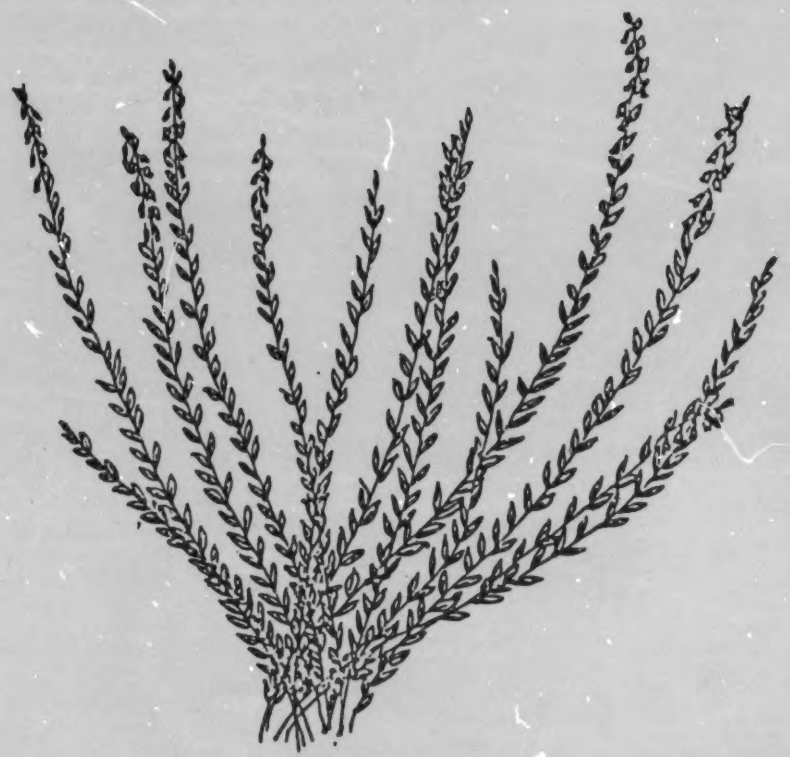
139

VENUS FLYTRAP

140

SWAMP LOOSESTRIFE

141



LEATHER LEAF

142

b2-9

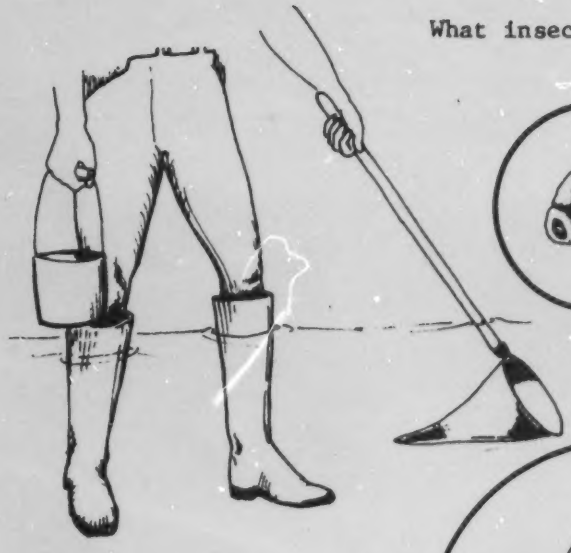
The Field Trip

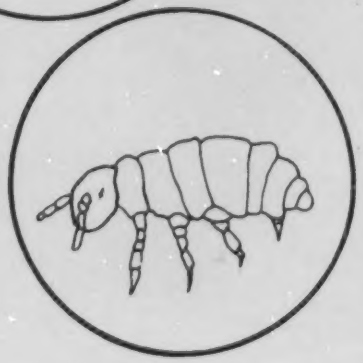
Chapter 3
Activity Sheets

Activity Packet 3
Field Trip Task Card 1

Insects in the Water

What insects can be found in fresh water?





Collect several specimens of each kind of insect from the wetland. Bring them back in a pail with lots of water. Add several handfuls of plants that grow under water.

Set up an aquarium to be as much like a wetland as possible.

1. What special body parts do the animals use to move in water?

2. Insects--like mammals--were originally land animals. They breathe air. What special body parts are used to breathe air while the animal is in water? Some water insects have gills like fish. Gills take in oxygen that is dissolved in water.

3. What do these animals eat? How do their mouth parts work?

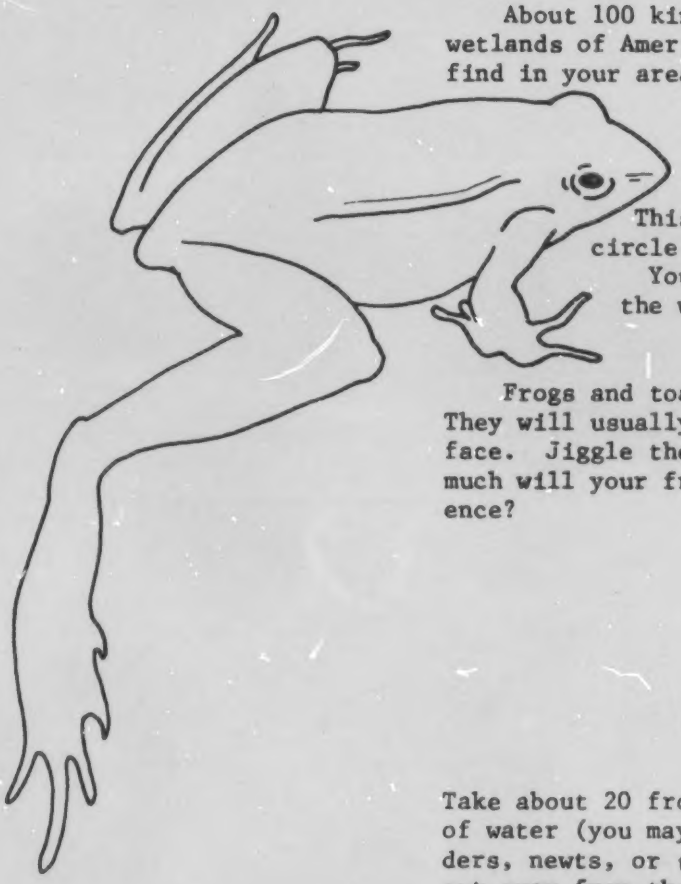
4. Draw pictures of the insects you have collected.

5. Which of the following kinds of water insects were you able to find?

____backswimmer	____diving beetles
____crawling waterbeetles	____mosquito larvae pupae
____damsel fly larvae	____midge larvae
____dragon fly larvae	____may fly larvae
____water boatman	____water measurer
____water striders	____riffle beetles
____water scorpions	____water scavenger beetles
____springtails	____water loving beetles
____whirligig beetles	____giant water bugs

Activity Packet 3
Field Trip Task Card 2

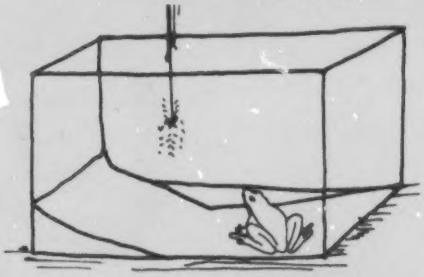
Frogs



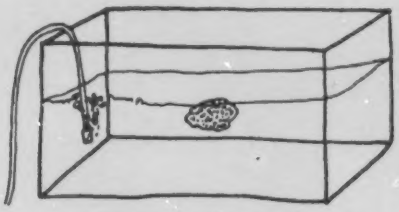
About 100 kinds of frogs and toads live in the wetlands of America. Which species of frog can you find in your area?

In Calaveras County, California there is an annual frog jumping contest. The present world record is 20 feet 3 inches (6.2 meters). This is the farthest from the center of a circle a frog will go in only three hops. You can't touch the frog! How close to the world record do your frogs jump?

Frogs and toads can be kept in aquarium tanks. They will usually eat food dangled in front of their face. Jiggle the string to make the food move. How much will your frog eat? Does it have a food preference?



Take about 20 frog eggs from your wetland in a bucket of water (you may discover that the eggs are salamanders, newts, or toads). Your sample of eggs can be cut away from the much larger mass of eggs with a knife. Raise the young in an aquarium. Each day make a new drawing of a growing tadpole.



And Some of their Relatives

Newts and salamanders are common in freshwater wetlands. There are about 135 kinds in America. They are easily collected with a net that sweeps along the bottom of shallow water. Others can be found in moist areas around the water, particularly under rocks.

Keep newts and salamanders in aquariums. Feed them live mealworms or tubifex worms. This food can be bought in pet stores.

Find a place where you can eavesdrop on a reptile of the wetland. Watch it for as long as you can. Write down everything it does.

Activity Packet 3
Field Trip Task Card 3

Make a Wetlands Plant Collection

MATERIALS

A. For the field trip

1. Plastic bag
2. Trowel
3. Notebook and pencil
4. Guide book to plants

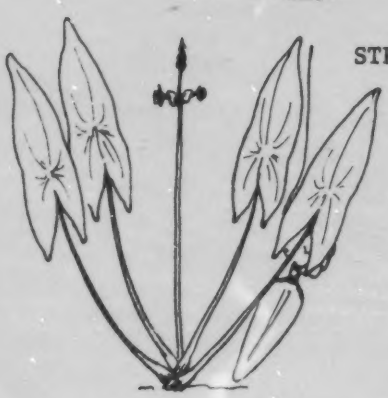
B. For the lab work

1. Two boards 12" x 18" (or plant press)
2. Newspapers
3. Blotter (11½" x 16½" or paper towels)
4. Corrugated ventilators (11½" x 16½")
5. Weights (box of stones or bag of sand) or straps
6. Plant display sheets (11½" x 16½")
7. Transparent tape

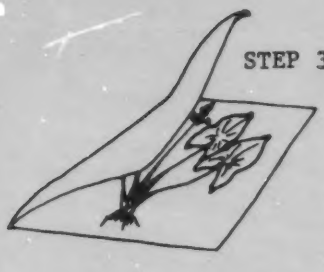
STEP 1 Find a plant that interests you. Find out its name. Write in your notebook things you can observe.

1. What is its name?
2. Where does it grow?
3. What color is it?

STEP 2 Collect the plant - make sure the plant is not rare and protected.



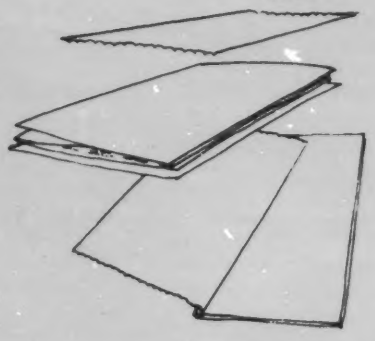
1. Carefully dig or pull the plant out of the soil.
2. Carry it back with other plants in a plastic bag.



STEP 3

1. Lay out the plant between the halves of a folded newspaper.
2. Add a note with your name, date, where collected, and name of plant if known.
3. Bend part of plant to fit 11½" x 16½" size.

STEP 4



Place blotter driers, paper toweling, or more newspaper under and on top of folded newspaper.

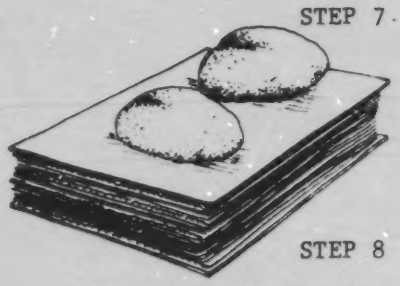
STEP 5

1. Place corrugated cardboard sheets above and below the blotter driers.
2. Place this stack on the board that forms the bottom of the press.

STEP 6

Continue to add blotter, specimens in newspaper, blotter, corrugated cardboard sheet, blotter, etc., until you have a stack no larger than ½ meter.

STEP 7



1. Place top of press on stack.
2. Add weight (box of stones, bag of sand) or strap the press together.
3. Change wet blotter for dry blotters every day and continue until blotter stays dry.

STEP 8

1. Mount dried plant specimens on sheets of white paper 11½" x 16½". Use transparent tape.
2. Add the label that gives name of plant, location found, date of collection, and name of collector.

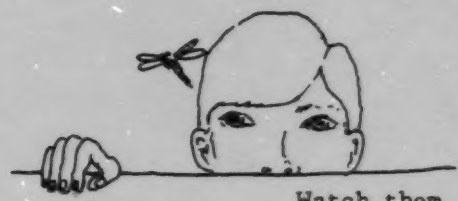
You might even make a frame and turn your collection into an art object to hang on the wall.

Activity Packet 3
Field Trip Task Card 4

Insects in the Air and on the Land

Draw them

Catch them



Watch them

Where can most of the insects be found?

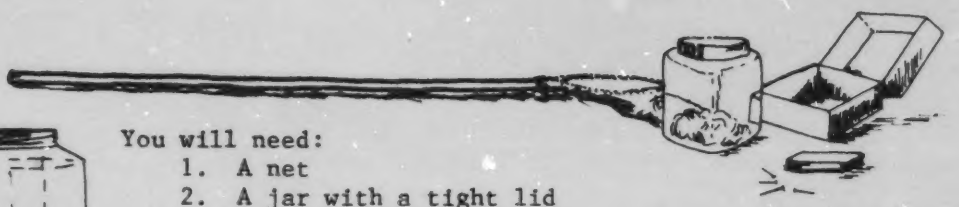
How many different kinds can be found?

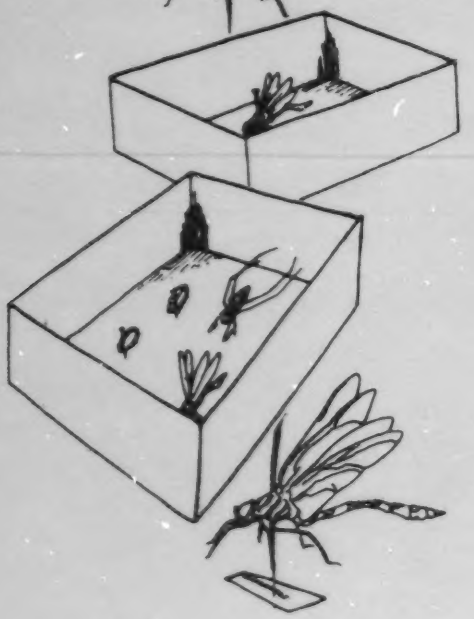
Describe the largest-smallest-most colorful-fastest-hairiest.

What is the flight pattern of a dragon fly?

How do ones in the air differ from ones on the land?

Make an Insect Collection





You will need:

1. A net
2. A jar with a tight lid
3. Cotton balls
4. Fingernail polish remover
5. Pins
6. Labels
7. A box

How to preserve your insects:

1. Soak the cotton balls in fingernail polish remover. Then put them in the bottom of the jar.
2. Catch an insect with the net. Place it in the jar.
3. After the insect is dead, remove it from the jar. Place a straight pin through the large part of its body.
4. Place the pin with the insect into the bottom of the cardboard box.
5. See if you can find several varieties to display together.
6. Identify the insects you have collected. If you need help doing this, ask your teacher about insect books that could help you. Write the name of each insect on a label.
7. Place the label under the insect so that you and others can identify it.
8. You might even make a wall hanging out of your collection.

Activity Packet 3
Field Trip Task Card 5

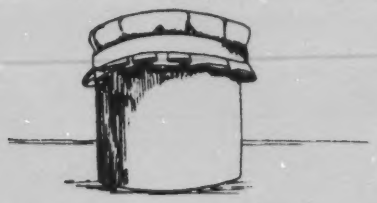
Exploration with a Water Scope

A water scope or "look box" will let you see into the water. You will be able to see fish and insects swim. Also you can find out what's going on at the bottom.

To make your water scope:

1. Remove both ends from a large (#10) can. Paint the inside of the can black.

2. Place a plastic bag or sheet of plastic wrap over one end of the can. Hold the plastic in place with a large rubber band. Carry an extra piece of plastic in case of an accidental tear.



3. Using your scope is like fishing. You must be patient and quiet.

Make a list of the things you see with your water scope.

4. Why do you think you can see more clearly with your scope than without it?

Activity Packet 3
Field Trip Task Card 6

Animal Signs

Look for clues of unseen animals that live in the wetlands.

feathers

nests

partially eaten food

tracks

droppings

runways

Make up a list of the animal signs that you discover.

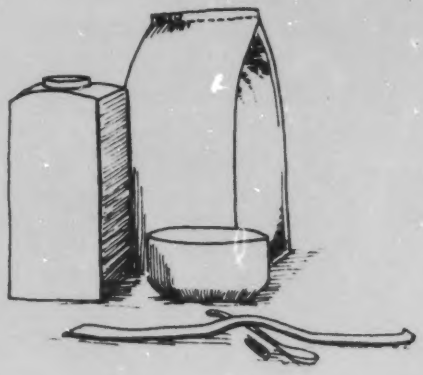
Collect specimens, or draw pictures of the signs in your notebook.

Then see if you can figure out what type of animal created the signs.

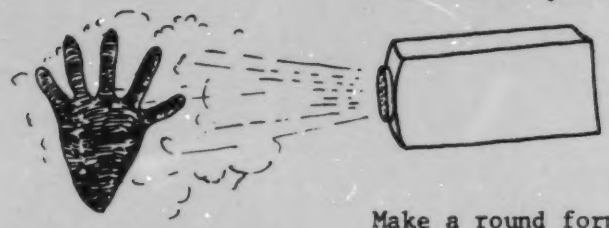
HOW TO MAKE PLASTER CASTS OF ANIMAL TRACKS

Materials

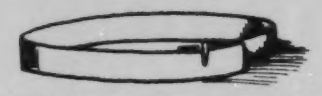
1. Talcum powder
2. Plaster of Paris
3. Plastic bowl
4. Spoon
5. 1" x 8" cardboard strip
6. Paper clip
7. Brush



Find a clear footprint of a bird or mammal. Dust it with talcum powder.



Make a round form by attaching the ends of the cardboard strip together. Hold them together with a paper clip.



Place the round form around the animal track.

Place about 2 cups Plaster of Paris mix into the plastic bowl. Slowly add enough water to make a goop about as thick as pea soup, stirring with the spoon.

Pour the soupy plaster into the cardboard form.

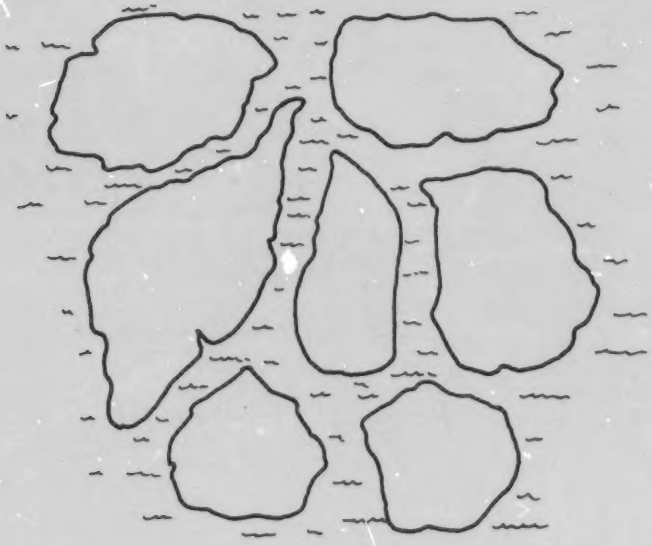
Smooth the plaster on the top to make a flat side.

Allow the plaster to harden. Then remove the hardened plaster from the form. Clean the cast of the track with a brush.

Activity Packet 3
Field Trip Task Card 7

Temperature

Sketch a map of the wetlands you are studying.



Choose several locations in the wetland and label them on your map. Use one thermometer to measure the temperature of the air at each location. Measure the temperature at ground level and waist high level. Write the temperature on the map.

Also, measure and record the temperatures of the mud at each location.

Then measure and record temperatures of the water at each location.

TEMPERATURE RECORD

Location	Air Temperature Ground	Waist	Mud Temperature	Water Temperature
1				
2				
3				
4				
5				
6				
7				

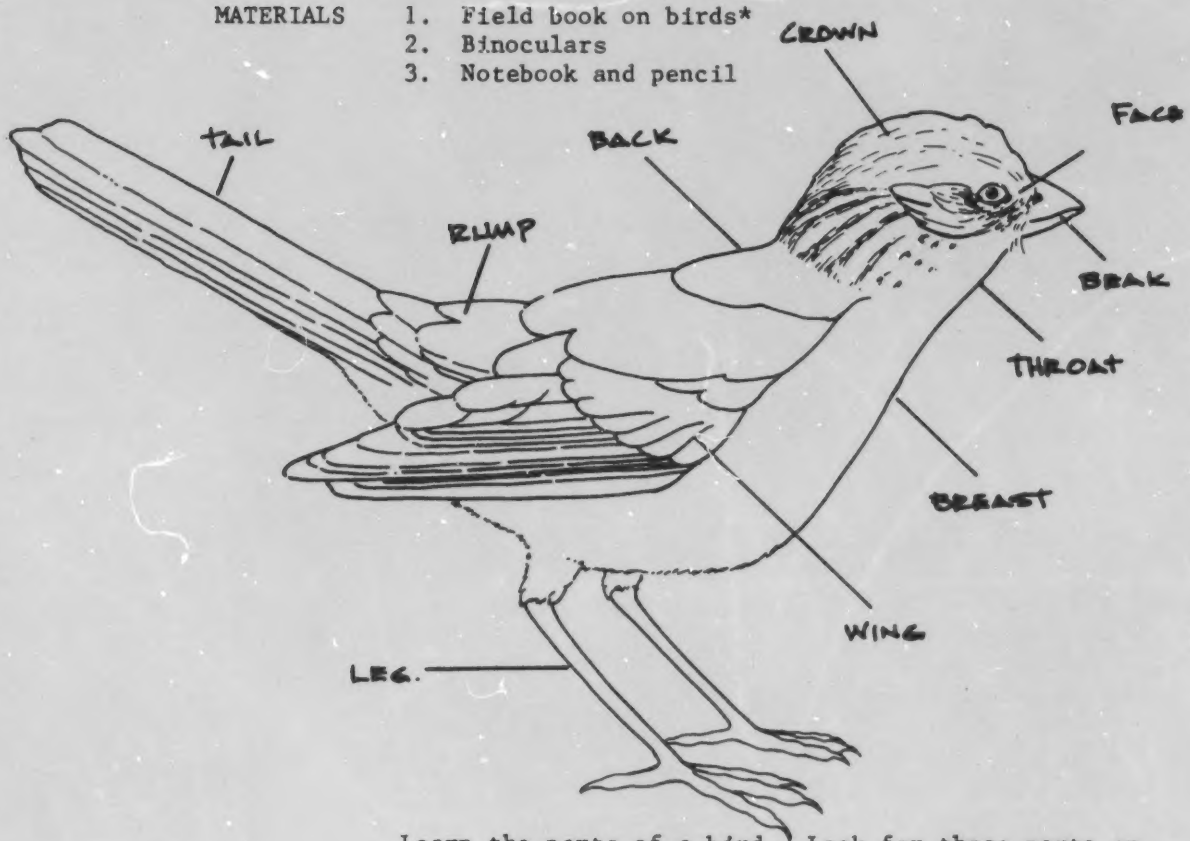
Activity Packet 3
Field Trip Task Card 8

Bird Watching I
Identifying Birds

How many different kinds of birds can you spot in the wetlands?

What are the names of the birds?

MATERIALS
1. Field book on birds*
2. Binoculars
3. Notebook and pencil



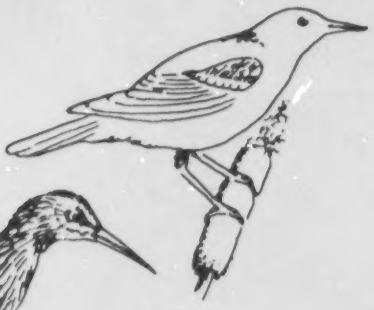
Learn the parts of a bird. Look for these parts on living birds in the wetland.

*Some good field guides on birds include:
1. A Field Guide to the Birds. Eastern Land and Water Birds. Roger Tory Peterson. Houghton Mifflin Publishing Company. Boston. 1947.
2. A Field Guide to Western Birds. Roger Tory Peterson. Houghton Mifflin Company. Boston. 1961.

PRACTICE NOTICING BIRDS

How big are they compared to a robin?

How do they differ in shape?

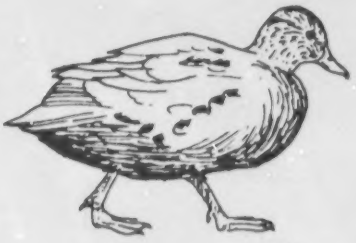


What is the bird saying?

What's special about each bird?

forked tail

walks in circles



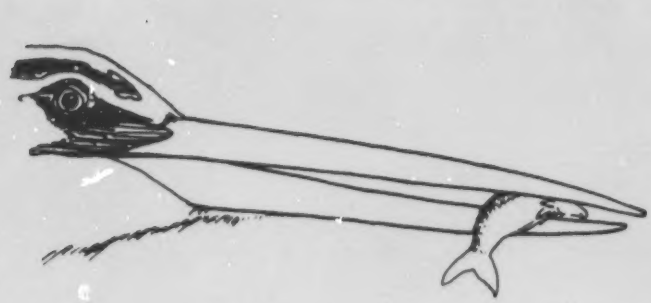
runs up and down a tree

Do they watch you?

Where are they usually found?

Now make a list of all the birds that you can see and name in 15 minutes.

What foods do the birds of the wetland eat?



Draw pictures of the beaks of birds at work catching and holding food in your wetland.

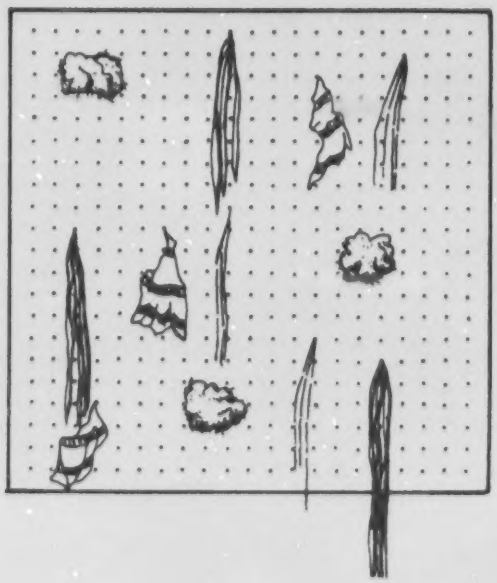
BECOME A NIDOLOGIST (a scientist who studies nests)

How many different kinds of nests can you find?

How many eggs, or young, live in one nest?

What are nests made of?

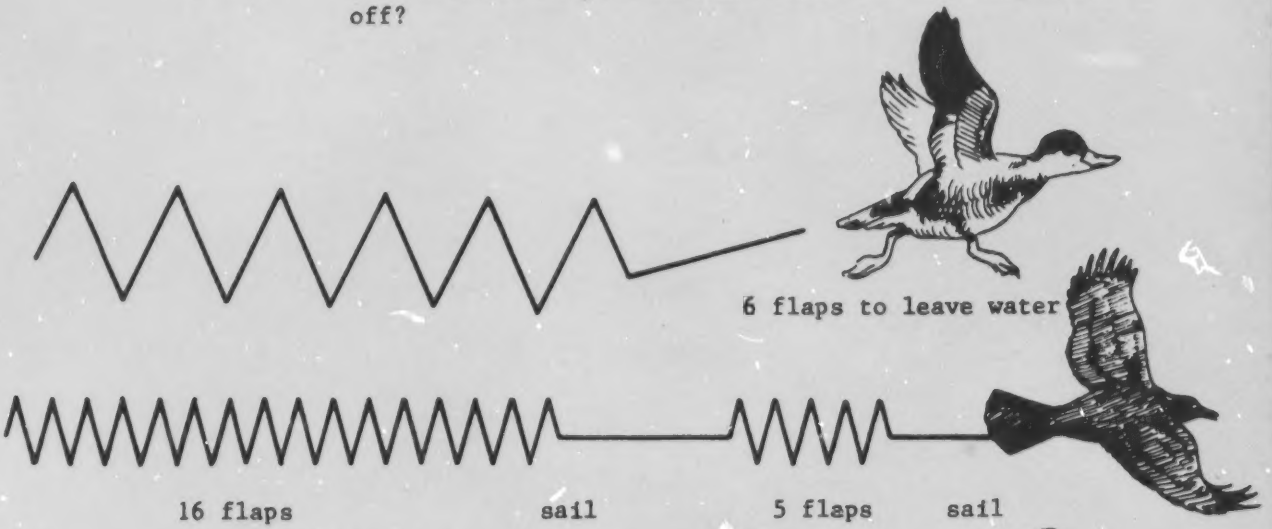
Set out a selection of materials nesting birds might select from. Watch the board with field glasses. Which materials are preferred by which birds.



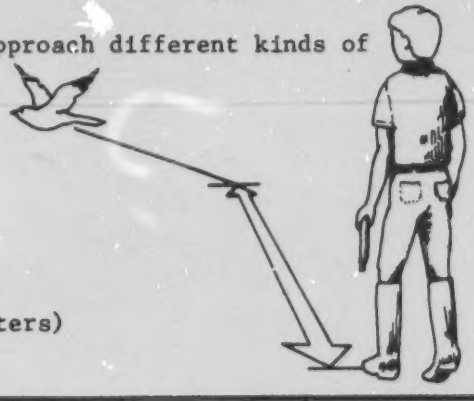
Activity Packet 3
Field Trip Task Card 9

Bird Watching II
Special Bird Study Projects

How do birds in your wetland differ in how they take off?



How close can you approach different kinds of birds before they fly off?



Fright Distance (meters)

Trials

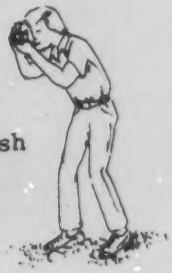
Bird	1	2	3	4	5	6	7	8	9	10	Average
Great Blue Heron											
Redwing Blackbird											

Activity Packet 3
Field Trip Task Card 10

Photography

Take a camera to a wetland and shoot the story . . . about an animal.

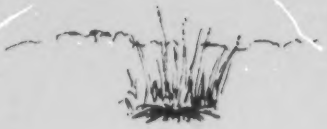
The duck of the marsh

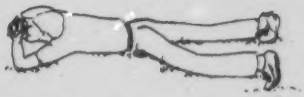


Tracks of the marsh duck

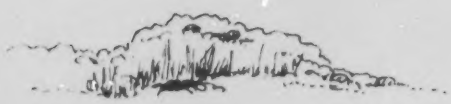
Marsh duck morsels

Marsh duck nest



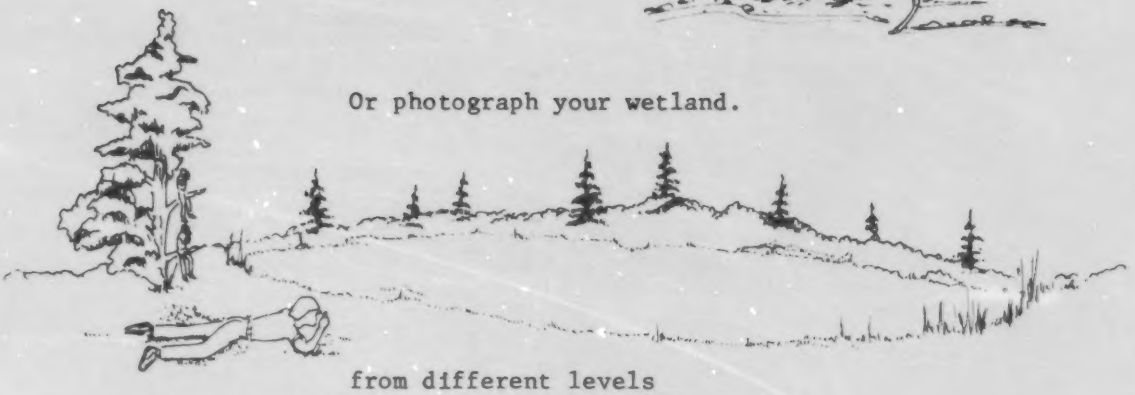


Homeland of marsh ducks



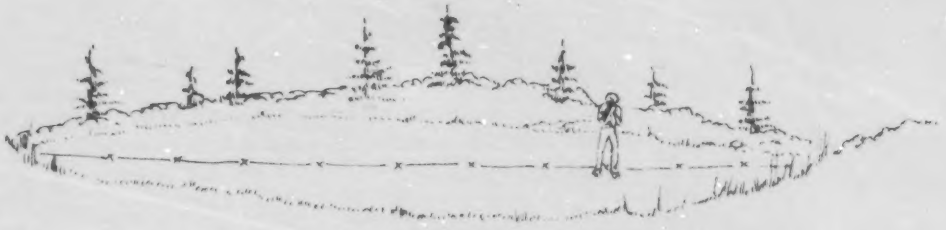
Or tell a story about how plants and animals interact in the wetland.

Or photograph your wetland.



from different levels

in all directions around a point



at points along a line

Activity Packet 3
Field Trip Task Card 11

Record an on the spot news broadcast for Station WETS

"Good day Mr. and Mrs. America. This is Jay Kay Caramanico speaking to you from the Yew Street Swamp.

"Today I am going to tell you all about animals and plants I see as I walk around and through the Yew Street Swamp. Later I will talk to Mrs. Pam Doolittle who lives next to this swamp. You may recall that Mrs. Doolittle wrote an angry letter to the Tribune. She's upset about what may happen to this swamp."

HERE ARE SOME MORE IDEAS FOR BROADCASTS

Prepare a TV program about life in a wetland.

Take some photographs of a wetland. Write a script to go with the pictures. Prepare your own slide/tape show as in Activity #1.

Write a radio play about a strange event that occurred in the wetland.

Interview persons who have different opinions about the importance of the wetlands in your community. Perhaps you can even record a discussion or formal debate.

Activity Packet 3
Field Trip Task Card 12

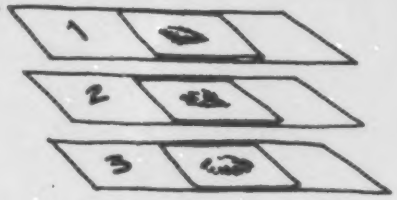
Mud

What can a microscope show you about the mud of a wetlands?

Collect samples of mud from three levels:

1. The top of the mud
2. The middle of the mud
3. The bottom of the mud

Make a thin slide of each sample of mud.



Look at each slide under a microscope.

Make drawings of about 3 pieces of mud from each level.

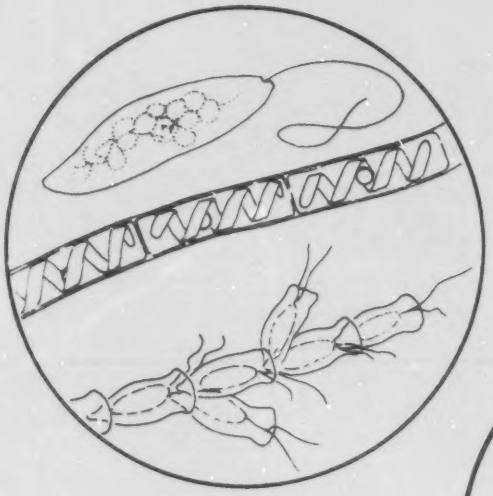
How do samples of mud from the top, middle, and bottom levels differ?

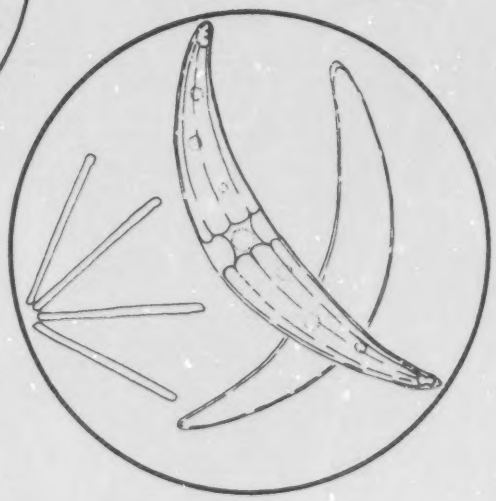
If you mixed all the slides up could you pick out which ones belonged to which level by the contents?

What organisms live in mud?

Use a microscope to explore your samples of mud.

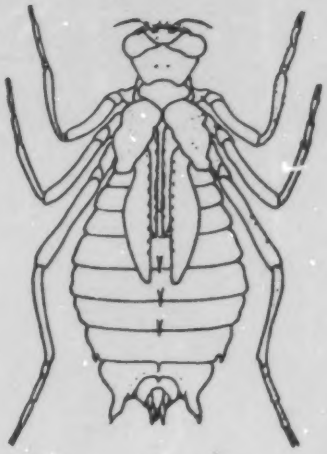
Whenever you see something that seems to be alive, draw a picture of it.





Group your drawings of organisms by color, by shapes, by size, and by the way they move.

Chapter 4
Activity Sheets



DRAGONFLY NAIAD

Various insect larvae
Tadpoles
Small fish
Zooplankton

DRAGONFLY

Various insects

Red-winged blackbird

ZOOPLANKTON

Phytoplankton
Underwater plants
Bacteria

Small fish
Dragonfly Naiades
Various insect larvae
Invertebrates

LARGE PLANTS

Plants use sunshine to make their own food.

Mouse
Shrew
Rabbit
Muskrat
Various insects

DETRITUS
(Decaying plants and animals)

→ Snails
Various insect larvae
Bacteria

VARIOUS INVERTEBRATES
(Animals without backbones)

Zooplankton ← → Waterfowl
Rails
Crayfish

PHYTOPLANKTON

Plants use sunshine to make their own food. → Snails
Zooplankton
Small fish
Tadpoles
Various insect larvae

WATERFOWL

Invertebrates ← → Peregrin falcon
Zooplankton Man
Snails
Underwater plants
Various insect larvae
Floating plants

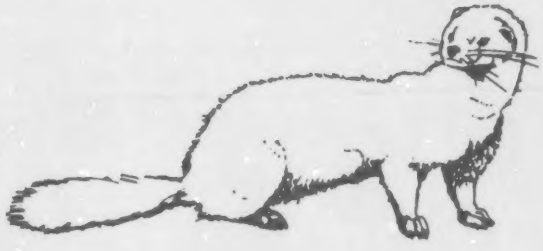
RED-TAILED HAWK

Mouse
Garter snake

MUSKRAT

Large plants
Underwater plants

Mink



MINK

Muskrat

SHREW

Mouse
Large plants

Long-eared owl

GREAT HORNED OWL

Rabbit
Mouse

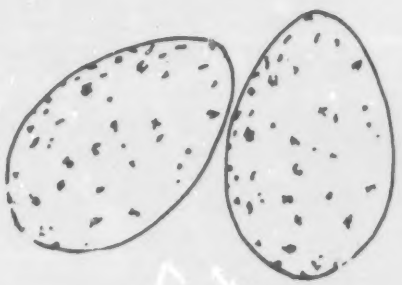
TADPOLE

Phytoplankton

Dragonfly larvae

PEREGRINE FALCON

Waterfowl

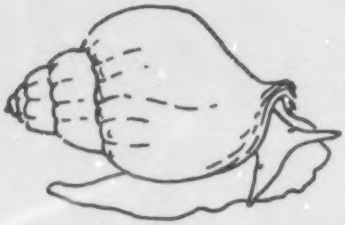


RAIL EGGS

Raccoon

FROG

Various insects → Herons, Garter snake, Osprey

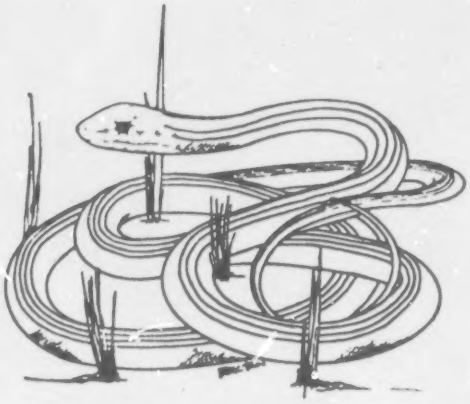


SNAIL

Detritus, Phytoplankton → Waterfowl

CRAYFISH

Underwater plants, Invertebrates → Raccoon, Rail, Heron



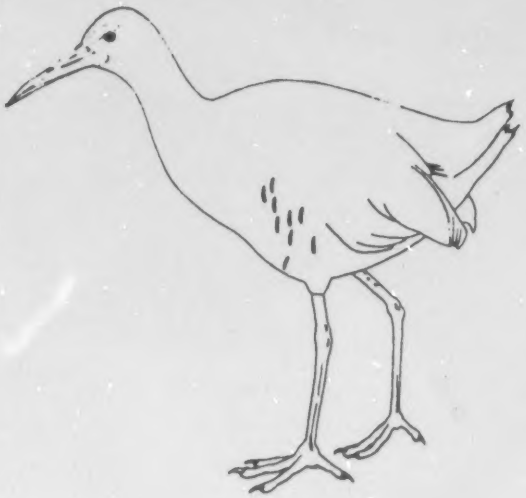
GARTERSNAKE

Frog → Red-tailed hawk

VARIOUS INSECTS

Large plants

Frogs
Dragonfly
Red-winged blackbird

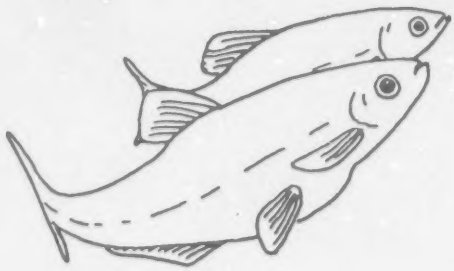


RAIL

Invertebrates
Crayfish
Small fish
Various insect larvae

OSPREY

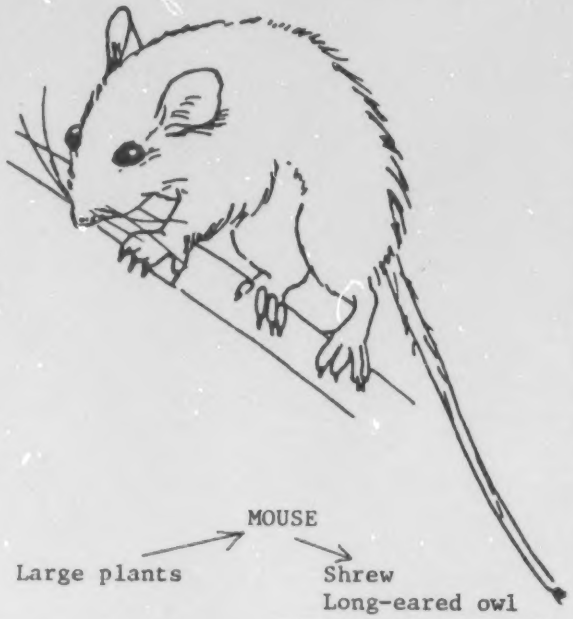
Small fish
Frogs



SMALL FISH

Phytoplankton
Zooplankton

Large fish
Man



MOUSE

Large plants

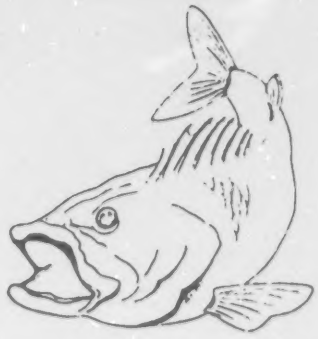
Shrew
Long-eared owl
Great horned owl
Red-tailed hawk

LONG-EARED OWL

Mouse
Shrew

RED-WINGED BLACKBIRD

Dragon fly
Various insects



LARGE FISH

Small fish

Man

MAN

Large fish
Small fish
Waterfowl

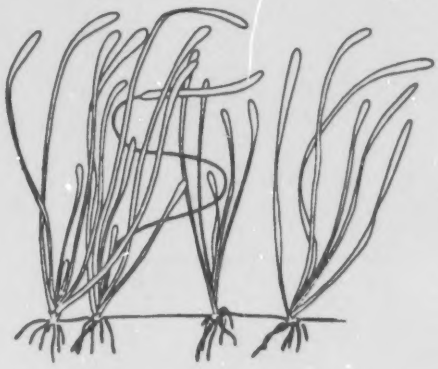
RABBIT

Large plants

Great horned owl

FOX SNAKE

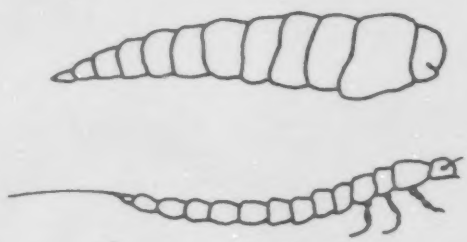
Heron eggs
Rail eggs



UNDERWATER PLANTS

Plants use sunshine to make their own food.

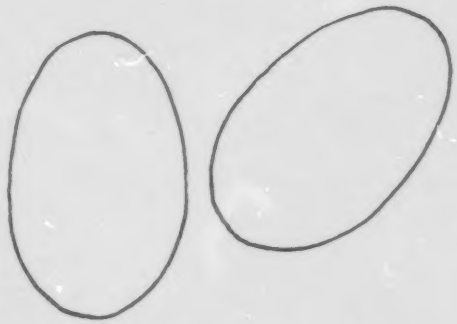
Zooplankton
Crayfish
Waterfowl
Muskrat



VARIOUS INSECT LARVAE

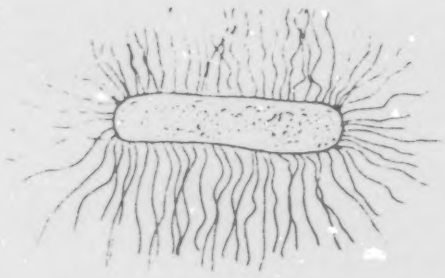
Phytoplankton
Zooplankton

Dragonfly larvae
Waterfowl
Rails



HERON EGGS

Raccoon



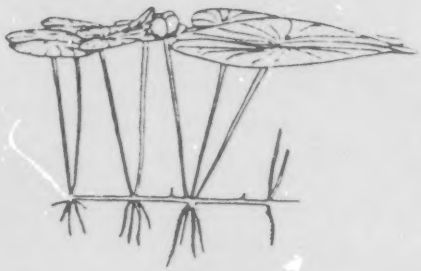
BACTERIA

Detritus

Zooplankton

RACCOON

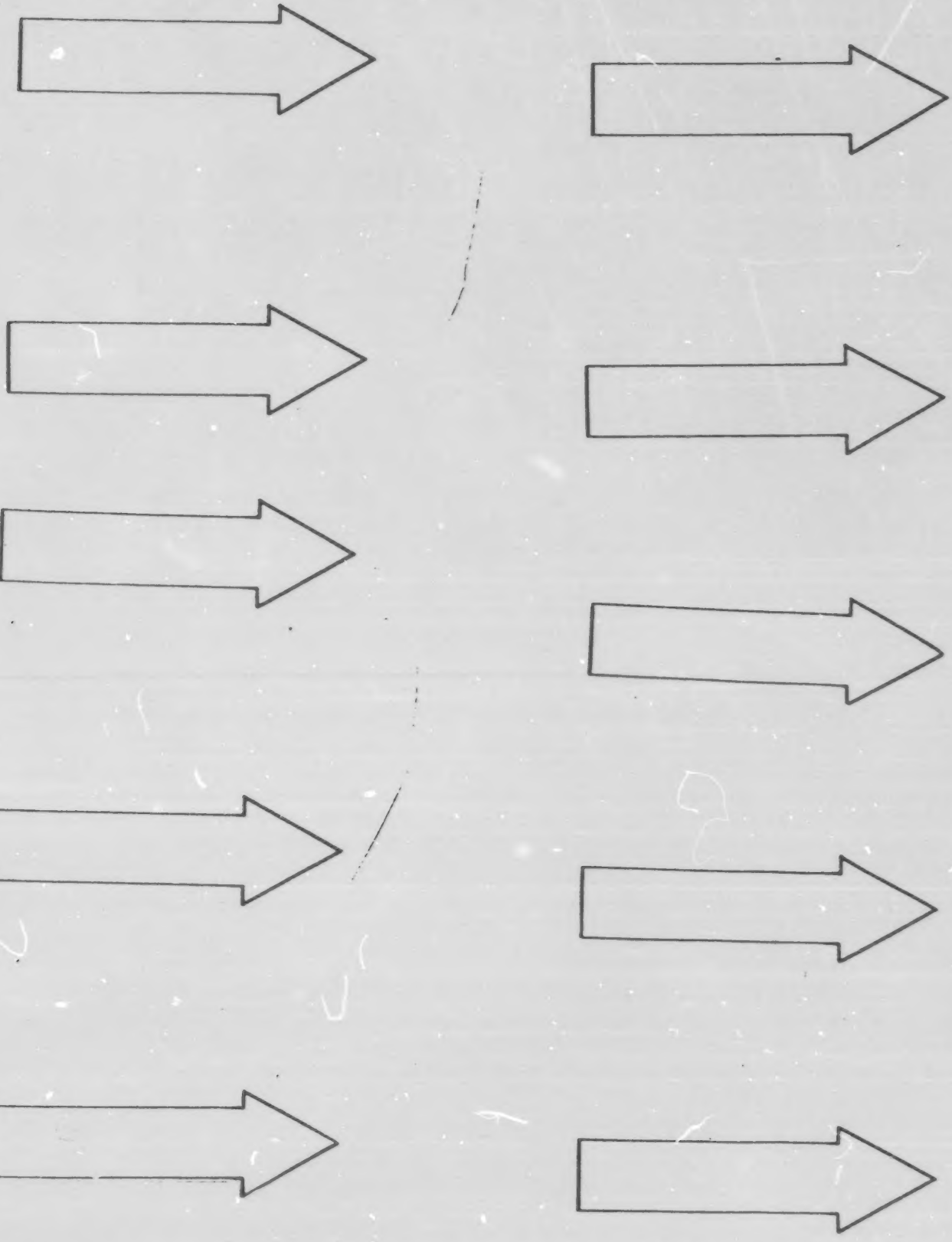
Heron eggs
Rail eggs
Crayfish

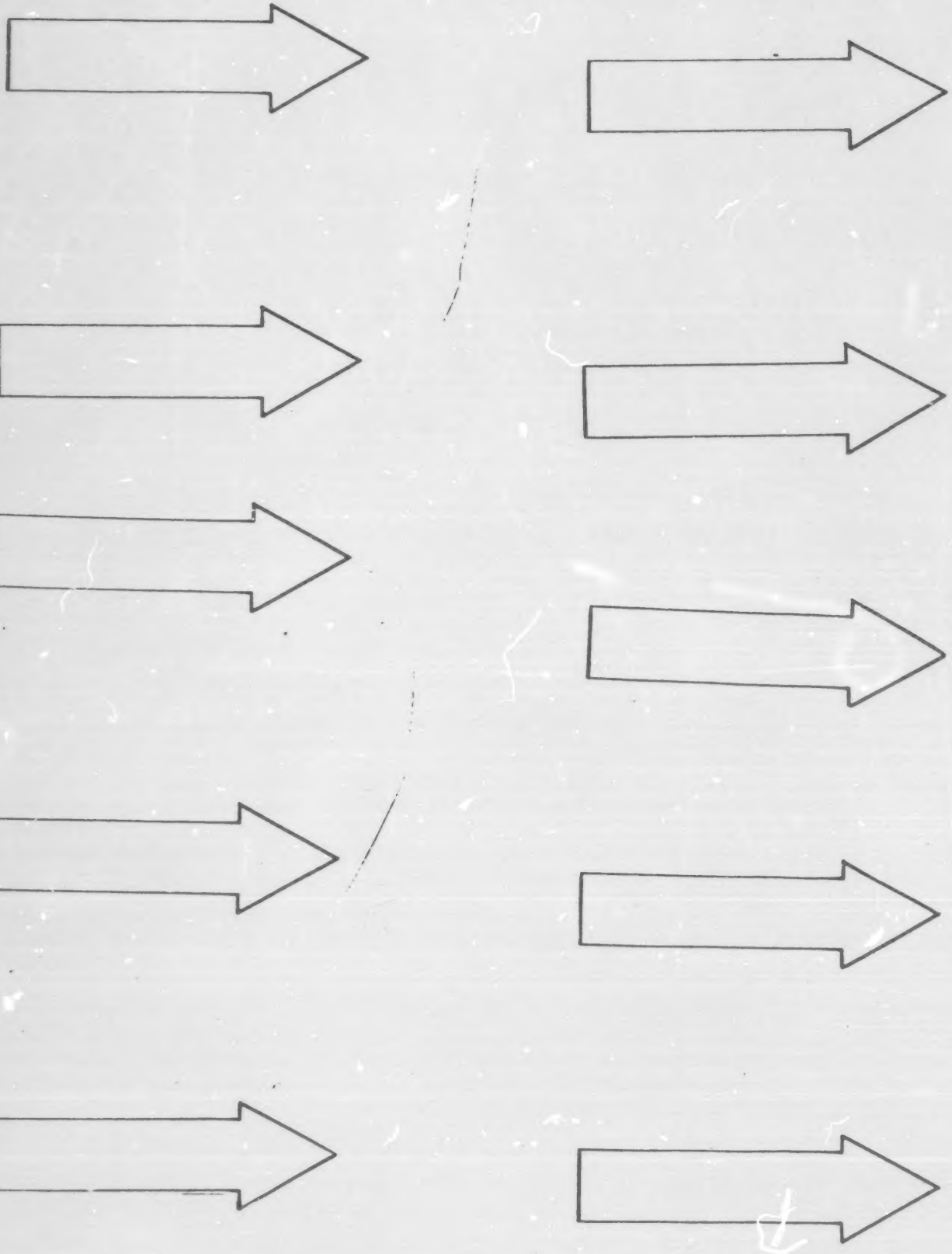


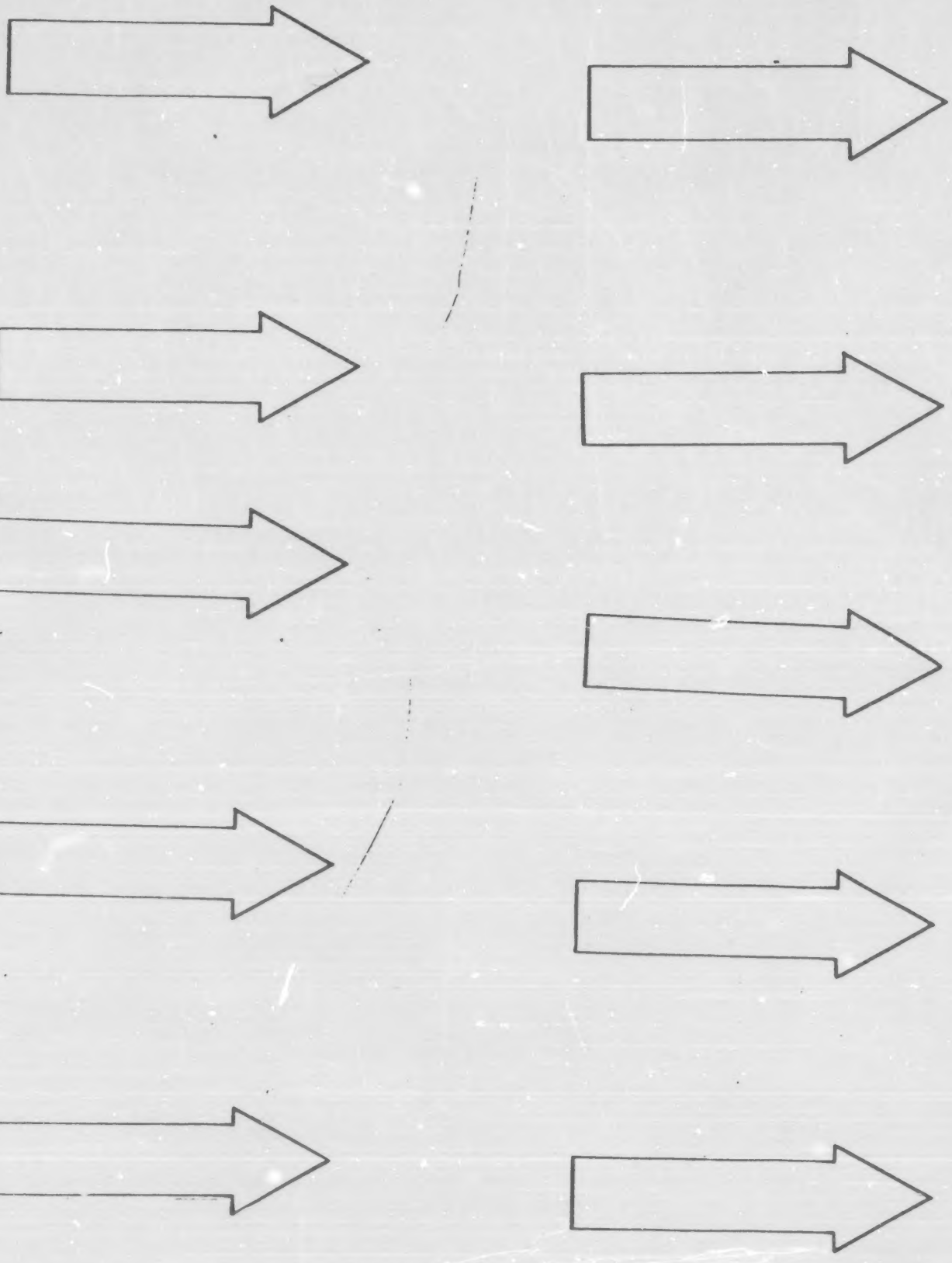
FLOATING PLANTS

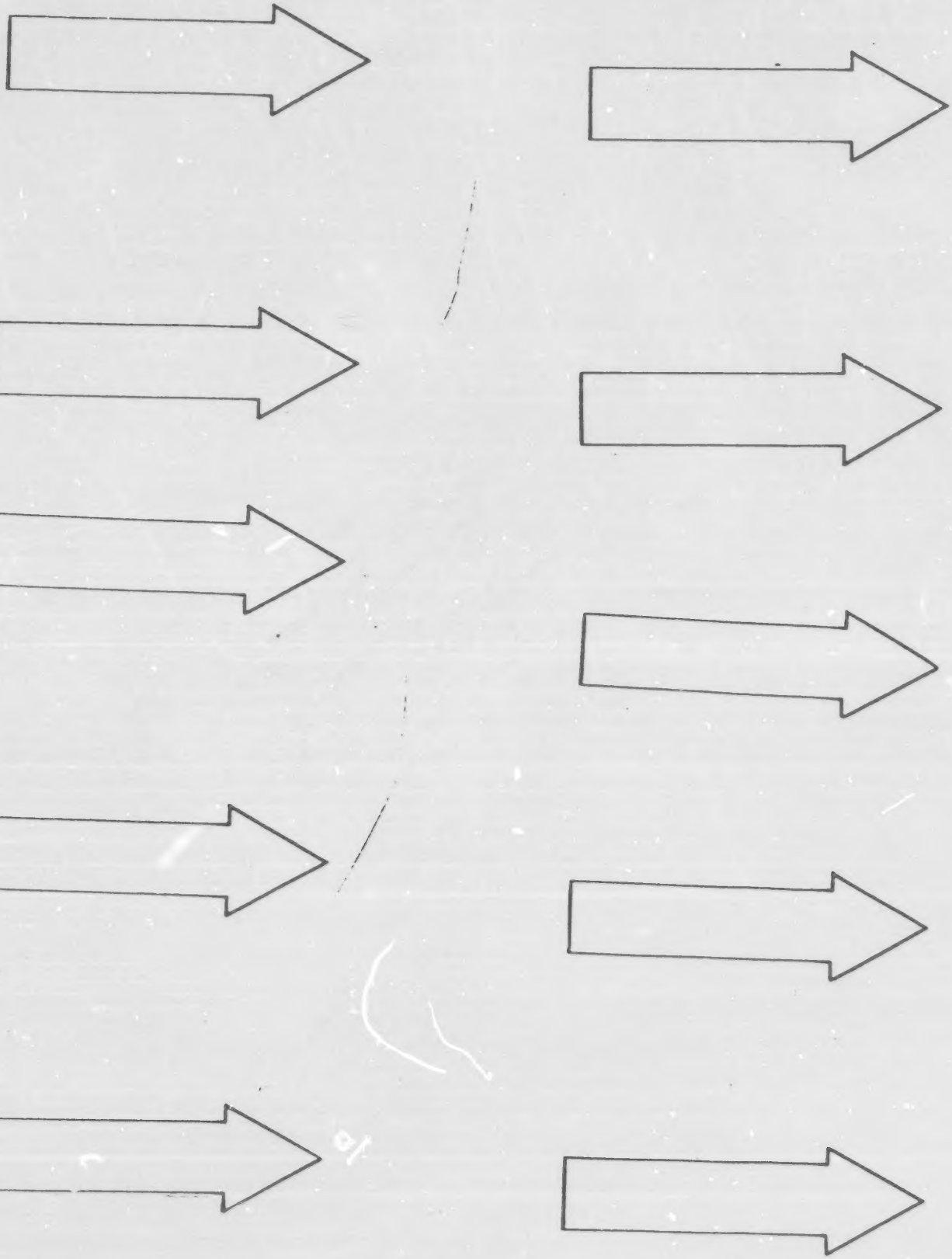
Plants use sunshine to make their own food.

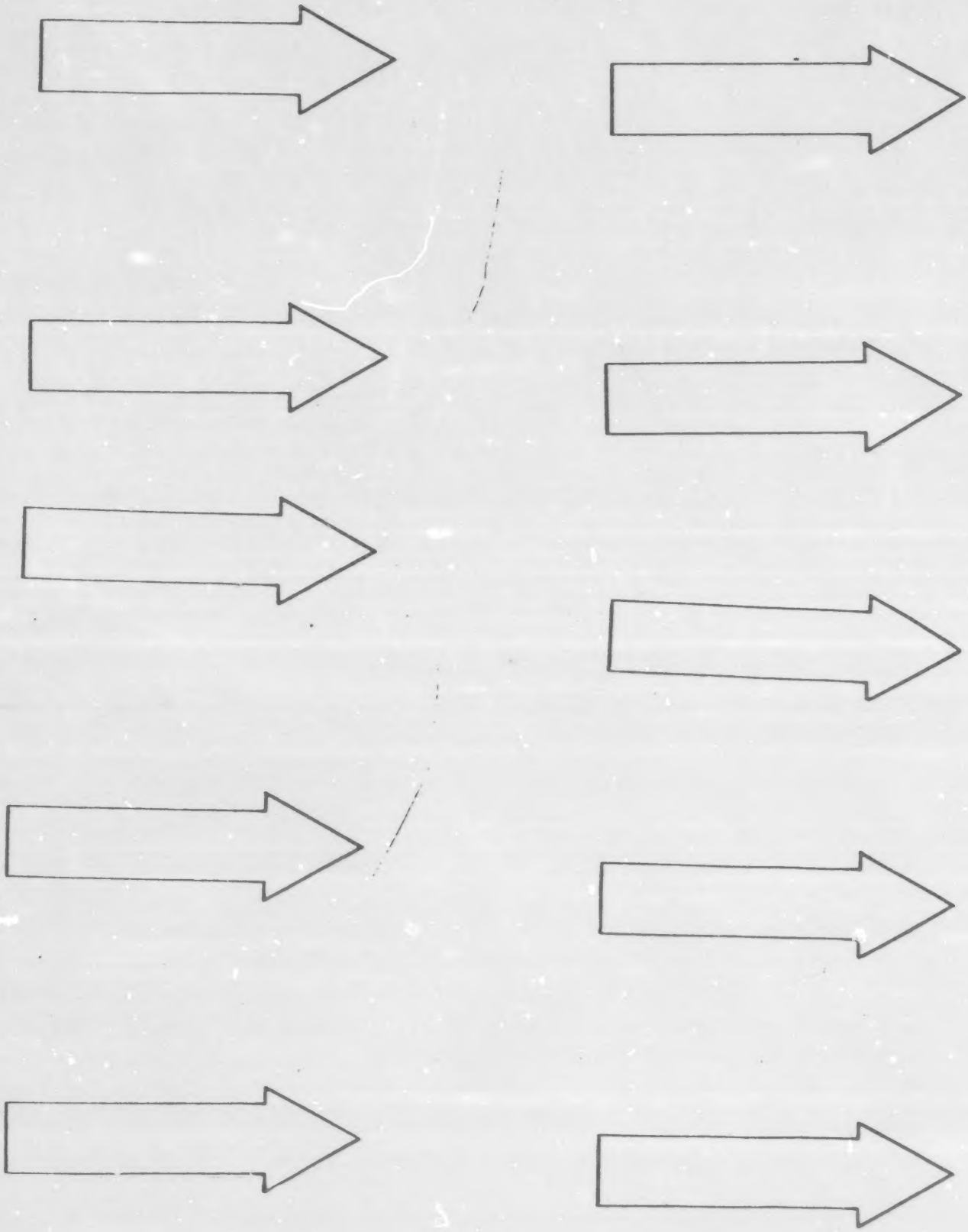
Waterfowl

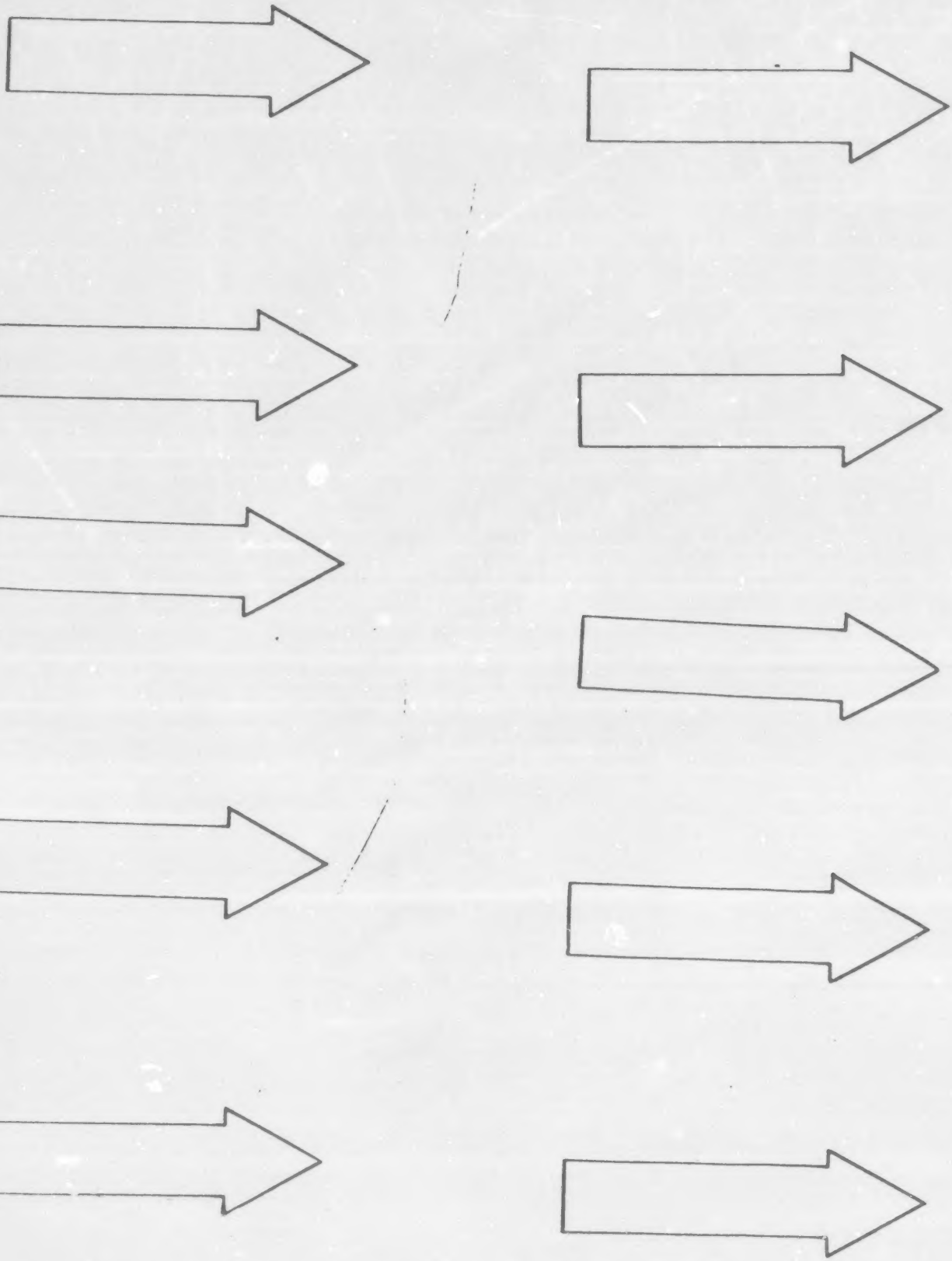










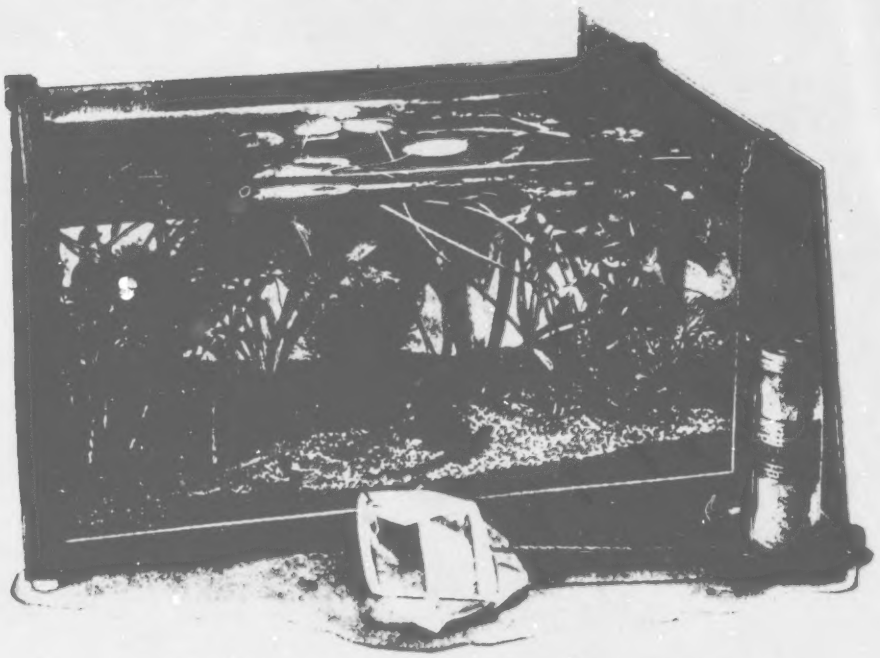


Study of a Wetland Organism

Chapter 5
Activity Sheets

TURTOX SERVICE LEAFLET No. 5

STARTING AND MAINTAINING A FRESH-WATER AQUARIUM



Photograph of the No. 45V11 Turtox Aquarium Outfit, as listed on page four of this leaflet.

Starting and maintaining a fresh-water aquarium in the school laboratory is easily accomplished by anyone who is willing to devote a little thought and care to the work. The pleasure and practical teaching advantages to be derived from one or more aquaria containing interesting plant and animal specimens is well worth the time and effort expended. Before starting your aquarium, however, make sure that you have the correct type of tank, the right quantities of aquatic plants and animals. Keep in mind the basic requirements of the specimens to be included in such a demonstration, because a fresh-water aquarium is a biological association of plant and animal life.

The following brief outline states the procedure to follow in establishing a fresh-water aquarium. If these directions are followed closely, no particular difficulty should be encountered.

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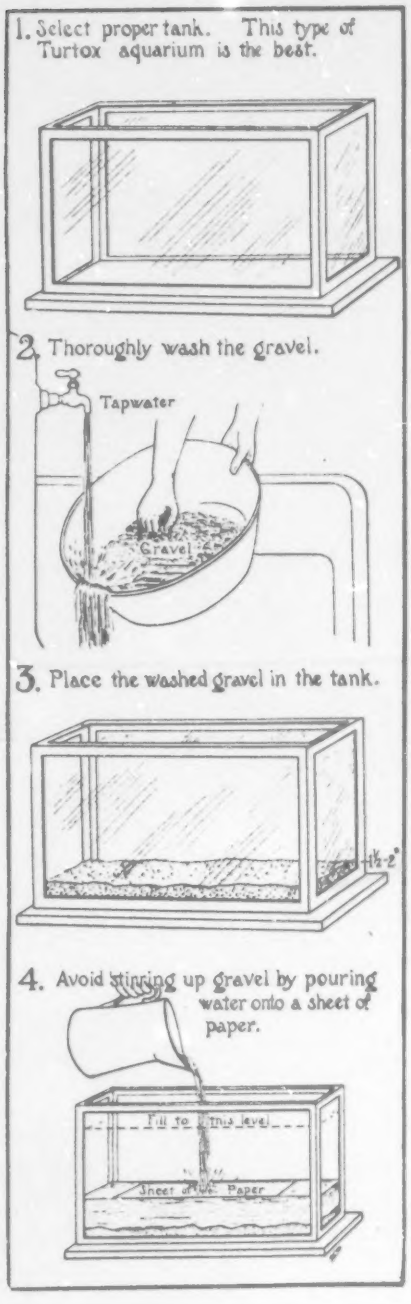

1. Select proper tank. This type of Turtox aquarium is the best.
2. Thoroughly wash the gravel.
Tapwater
Gravel
3. Place the washed gravel in the tank.
1½-2"
4. Avoid stirring up gravel by pouring water onto a sheet of paper.
Fill to this level
Sheet of Paper

Equipment. The only absolutely essential piece of equipment is a suitable aquarium tank; a rectangular tank with metal frame, glass ends and sides, of about 6 to 9 gallon capacity is recommended. Small, round aquaria are not satisfactory (visibility is poor through curved glass), and the round fish globes are useless. In addition to a suitable tank, the following items will prove their usefulness: dip-net for transferring fish, one pair of long aquarium forceps, one pair of plant snips and a syphon tube.

HOW TO START THE FRESH-WATER AQUARIUM

1. Clean the tank thoroughly, removing all dust, grease, etc., from the glass. If the tank has previously been used as an aquarium wash very thoroughly with soap and ammonia water. Rinse with clear water three or four times.

2. Clean thoroughly, in *running water*, sufficient aquarium sand or gravel to cover the bottom of the tank to a depth of one to two inches. Continue washing until all debris and soluble matter has been removed. Place the sand in the aquarium.

3. Now add the water. Use clear pond water if possible; if this cannot be obtained, use tap water which has stood in open containers for a day or so. Pour the water into the aquarium (using a sheet of paper as shown in illustration) until it is 6 or 8 inches deep. After it has been planted add more water to fill the aquarium. (*Important*: Chlorinated city water is *not safe* to use unless it is allowed to stand in open containers for 48 hours.)

4. The aquarium should be placed where it will be exposed to strong diffused light. Direct sunlight for an hour or so each day is usually not harmful, but neither is it necessary. North or East exposures are usually best.

5. The aquarium is now ready for planting. Plants are used for a variety of functions in an aquarium. They provide a natural habitat and protection for small fishes. Plants utilize some of the excreta thrown off by the fish and other animals while they, in turn, are used as food by some species of fish and snails. They also promote the growth of microorganisms and other small animals.[1]

It is well to use plants rather sparingly at first, remembering that they will soon grow and spread. If too many are crowded in at the beginning some

may die and decay, thereby fouling the water. All plants will not thrive in an aquarium and it is best to secure tank-grown (not wild) aquatic plants of kinds that are known to grow well in aquaria. Vallisneria, Sagittaria, Elodea (Anacharis), Myriophyllum and Cabomba are all good. Many other plants can be grown successfully in an aquarium, but the ones mentioned give variety and are dependable.

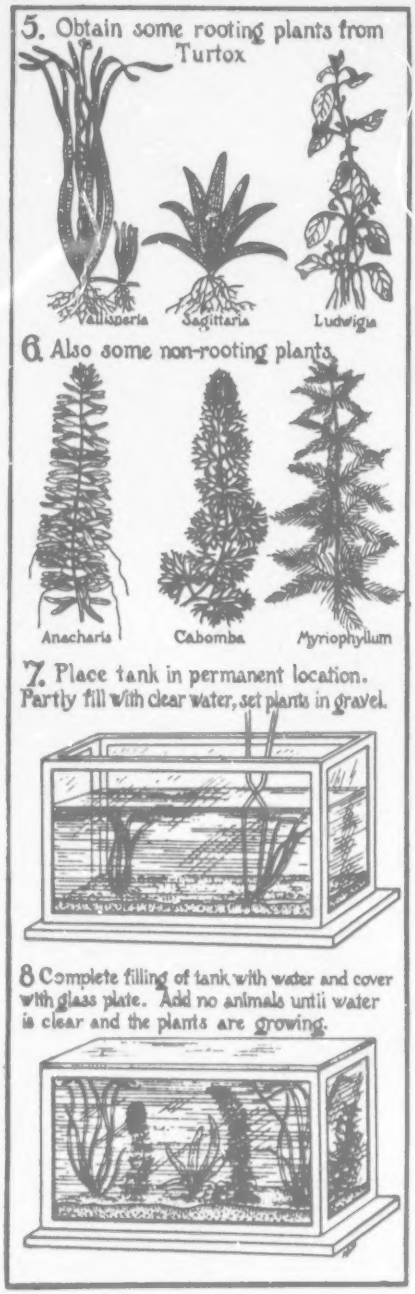
6. Plant the aquarium as follows: Take several of the rooted plants (such as Vallisneria and Sagittaria), spread the roots out on the sand and cover them up to the crowns, pressing them down to secure anchorage. Add several stalks of the non-rooted plants (Elodea, Myriophyllum and Cabomba), weighting the lower ends down with small stones or with pieces of lead. Arrange the upper parts of the plants so that they float freely in the water, and remove all dead or broken leaves. Now fill the aquarium with water to within one inch of the top.

If the conditions are right, growth should be noticeable in about two weeks after planting. If the water does not become clear in a day or so it is usually an indication that it contains some dead and decaying plants or other organic matter.

7. Allow the aquarium to stand for a few days until the water has cleared, when it will be ready for its animal population. (Snails, fishes, etc., can be placed in the aquarium immediately after planting if necessary, but it is best to wait until the water is clear.)

8. In stocking an aquarium several things must be borne in mind. First, use only animals which get along together; predaceous forms must be kept by themselves. Second, do not use animals (or plants) which naturally live only in running water, as they will not live in the close confinement of an aquarium. Third, do not overcrowd. Fourth, do not use animals which will stir up the sand on the bottom and keep the water cloudy.

9. ***Animals. Fish.*** It is important not to over-crowd an aquarium with fish. A good rule to follow is one inch of fish to one gallon of water. The average six-gallon tank will support six one-inch fish or three two-inch fish. This rule cannot be followed in all cases. The number of fish used must be governed by the number of other animals to be included in the


5. Obtain some rooting plants from Turtox
Vallisneria
Sagittaria
Ludwigia
6. Also some non-rooting plants.
Anacharis
Cabomba
Myriophyllum
7. Place tank in permanent location. Partly fill with clear water, set plants in gravel.
8 Complete filling of tank with water and cover with glass plate. Add no animals until water is clear and the plants are growing.

aquarium and the surface area of the water. It is usually advisable to use several small fish rather than one large one. Small native fishes (minnows, dace, bullheads and sunfish) are far more interesting than the sluggish goldfish. If fish are not obtainable, snails, newts and aquatic insects will add much life and interest to the aquarium.

Snails. Six to a dozen snails may be kept in a 6-gallon aquarium. Snails are valuable as scavengers and will help keep the algae from the glass. Various species of pond snails (egg layers), and red snails, may be used. If possible, one or two viviparous (live bearing) snails should be included.

Clams. One small clam, an inch to two inches long, may be used. This is an interesting form to study, for the inhalant and exhalant siphons show perfectly. The clam should be watched closely to see that it is living, as it will disintegrate quickly and foul the aquarium if it should die.

Newts. Several small newts can be kept in the aquarium. They are active, interesting and relish small bits of raw meat as food.

Reference:

[1] Atz, J. W. "The Functions of Plants in Aquaria", The Aquarium Journal, Vol. 21, No. 2 and 3, February and March, 1950, pp. 10-13; 56-60.

10. Watch the aquarium carefully for the first few weeks. Remove at once any dead animals and clip off the dead parts of plants. After the plants have become established it may be necessary to remove some of them to prevent over-crowding.

FEEDING THE AQUARIUM ANIMALS

This subject is discussed in Turtox Service Leaflet No. 23 and will be mentioned only briefly here. The most important rule to be followed in caring for aquarium animals is—*Feed Sparingly.* Because higher animals must be fed often it is but natural that one should view with alarm the prolonged fasts of the cold-blooded animals. However, these forms can go for long intervals without food and remain perfectly healthy. Most of the small native fishes will do well on a balanced food, such as the Turtox Natural Fish Food. They also relish living crustaceans, such as Daphnia or Cyclops, and finely chopped live earthworms. Newts will eat tiny pieces of raw meat, raw fish or small pieces of living earthworms. The snails and clams need not be fed, as they can shift for themselves in an aquarium containing plenty of living plants. They also feed upon the excess fish food.

Living specimens are not sold to students; orders must be placed by the teacher or school.

45V10 Turtox Aquarium Set. A thoroughly dependable collection of plants and animals for the balanced fresh water aquarium. Includes sufficient material to stock a standard 6 to 9 gallon aquarium tank.

Plants:	Animals:
Sagittaria	Snails of two kinds
Ludwigia	Two aquatic Newts
Vallisneria	One small clam
Cabomba	(Or other aquatic animal.)
Myriophyllum	
Water Poppy	
(Or other plants may be substituted.)	

Set as described **$5.00**

45V11 Turtox Aquarium Outfit. Includes the special new Turtox Aquarium of 6-gallon capacity made of polished bulb-edged glass with slate bottom, one-piece metal frame and removable glass top (see page 1), 1 bag Turtox washed aquarium gravel, 1 jar Turtox Natural Fish Food, and 1 aquarium dip net. Complete outfit with instruction leaflet **18.50**

45V12 Complete Aquarium Outfit with Plants and Animals. Consists of Nos. 45V10 and 45V11 described above. Both for **23.50**

205A41 Aquarium Forceps, Wooden forceps, 18½ inches long. Each **$1.10**

205A54 Aquarium Dip Net. Each ..... **.75**

205A47 Aquarium Siphon. Flow of water starts automatically. Made of glass with rubber connections. Length, 12 inches. Each..... **1.40**

Write for current information on tanks, aerating pumps, air breakers, heaters and thermostats.

FOODS AND REMEDIES

55V21 Turtox Natural Fish Food. A balanced food. Per 100 cc jar **.75**

55V24 Shredded Shrimp. Per 100 cc. jar ..... **.50**

55V41 Fungus Cure for Fishes. Per ounce of concentrated crystals. **.50**

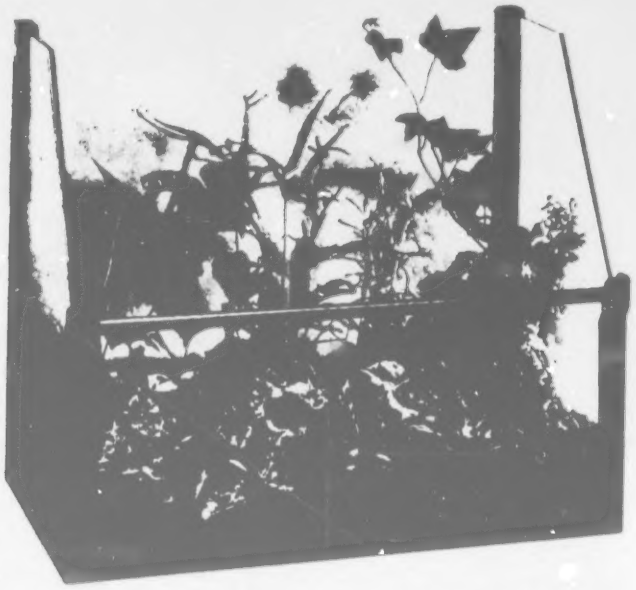
55V42 Salt Bath for Fishes. A combination of three mineral salts. Per ounce ..... **.50**

55V44 Medicated Aquarium Hi-Ball. For neutralizing acidity in the water. Each..... **.25**

All prices are f.o.b our laboratories and are subject to change without notice.

THE SCHOOL TERRARIUM

A terrarium is a most worthwhile unit for every biology room or laboratory because it affords an opportunity to study and arrange an unlimited variety of plant and animal groups. The purpose in maintaining a school terrarium may be of a two-fold nature: to represent native flora and fauna as objects of general interest or to have it form a definite part of the class work—to show the interrelationship of such environmental factors as food habits, temperature and moisture upon plant and animal associations. The student's interest is stimulated greatly if he makes his own collection of native plants and animals and if he arranges and cares for the terrarium.



A Typical Woodland Terrarium Group

For the terrarium case in which the plant and animal groups are to be placed, one may use almost any type of container large enough to accommodate the group, for example: a wide-mouth gallon jar, a battery jar, a fish bowl, an old aquarium or a specially built terrarium case. However, the size of the case will limit the number of plants, which may be included, for instance, a six by eight inch battery jar will accommodate only a small amount of stone and soil, one clump of moss, a fern and a small partridge berry plant. Such small terraria are usually short lived and useful for only a few weeks of study.

Our experience with terraria has proven that a large case is easier to plant and maintain than a small one. A rectangular tank, with metal frame and glass sides and ends, of from 6 to 10 gallons capacity (either an aquarium tank or a specially built terrarium case with slanting glass front) is the most practicable terrarium receptacle. The

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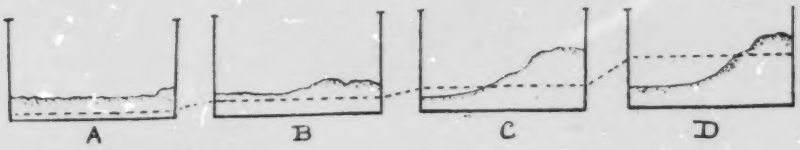


Water Level in Terraria

The dotted line indicates the proper water level in terraria of:—A Desert or Dry region Habitat, B. Woodland Habitat, C. Bog Habitat and D. Swamp or semi-aquatic Habitat. The water level can be watched and kept right in terraria which are housed in rectangular glass aquarium tanks.

terrarium should hold water for it may be desirable to include bog and semi-aquatic plant groups in it. It should have a glass cover so as to maintain the proper humidity, to avoid sudden changes of temperature, and to protect the plants from drafts or harmful gases in the air.

Just as the size of the tank will determine the number of plants and animals which will thrive successfully in it, so also will the type of habitat to be illustrated affect the choice of specimens. It is well to strive to reproduce as nearly as possible the natural habitat of the plants and animals and to arrange them in it accordingly. A dry woodland terrarium should not include bog plants such as the Venus' flytrap and Sphagnum moss; neither should an animal which normally lives in moist situations, such as the red-spotted newt, be placed in a desert terrarium.

A battery of from four to six terraria will enable the teacher to demonstrate many living ecological groups. Typical habitats easily reproduced in laboratory terraria are: desert, dry woodland, wet woodland, bog and semi-aquatic. The contents of such terraria may be varied to suit the season and teaching requirements. The main factors to be considered in establishing and maintaining terraria are: humidity, light and temperature, appropriate soil mixtures and suitable living specimens.

The problem of humidity control in the terrarium, when it is situated in a dry and overheated laboratory, is simplified when a glass-covered case, as described above, is used. The glass cover should fit *rather closely* but *should not* entirely prevent the circulation of air. To demonstrate the necessity for a humid condition, remove the glass cover from a terrarium in which a *Selaginella* is growing. Within a day or two the plant will begin to wilt, and the addition of water to the roots will not change the unhealthful appearance. After two or three days replace the top and in a very short time the plant will return to its original healthful appearance. By controlling the humidity properly one will be able to keep delicate ferns, mosses, liverworts, tree frogs, and salamanders for long periods of time.

Desert and dry region forms, such as cacti and lizards, may be kept in glass tanks which are covered with screen instead of a glass plate.

In general, the terrarium should receive plenty of light. The north window is an ideal location for woodland groups consisting of ferns, mosses, newts and tree frogs because direct sunlight is not essential. On the other hand, cacti, alligators, lizards, turtles and most snakes require sun and will not thrive unless they can be kept in a sunny location.

The bog, woodland and semi-aquatic terraria should be kept at a temperature of 65° to 72° F. for this is conducive to the normal growth of both the plants and animals. Higher temperatures have a tendency to force the plants; overheating may even kill them and thus make it necessary to restock the tank. Extremely low temperatures (near freezing) retard the plant growth and the animals do not feed properly, either. The plants and animals of the desert terrarium will thrive if the temperature is maintained at from 80° to 90° F. It is sometimes necessary to suspend an electric light over the terrarium in order to maintain this temperature.

In the preliminary preparation of the terrarium for planting, the foundation or base material is of utmost importance. Plants require air at their roots as well as around their leaves. A heavy soil mixture and poor ventilation of the base are often more at fault in a poorly growing terrarium than the factors of light and temperature. Sufficient coarse material should be included in the base to allow for good drainage and aeration. Suggestions as to soil mixtures will be given in each discussion of the different terrarium habitats.

In setting up the terrarium there are

always a few unwanted guests in the soil mixture which damage plants and animals and destroy the beauty of the finished planted garden. It is possible to sterilize the base mixture by heating it in an oven or by pouring boiling water over the entire mass. Although these procedures are usually successful in removing pests so also do they remove the bacteria and fungi beneficial to the plant life. If the tank is not too large the best plan is to keep on the alert for pests and remove them when they appear, or to spray the plants with some insecticide.

The base material should be slightly moistened and may be arranged in any desired manner. It should cover the entire bottom to one-fourth the height of the container. An attractive terrarium is one in which the soil is arranged unevenly with hills and hollows, high in back and low in front and a few pieces of stone and wood placed here and there to vary the scene.

The Desert Terrarium

The simplest group to assemble and one which requires the least amount of attention is the desert terrarium. The tank bottom may be covered over with one and one-half inches of coarse sand and topped with one-half inch of real desert sand. A few stones and a shallow pan of drinking water for desert animals may be added—the pan should be partially buried in the sand so that its top edge is even with the surface. The lower layer of coarse sand should be moistened slightly when it is placed in the tank; but the top layer should be kept reasonably dry.

The desert scene may now take form. The cacti may be planted; the larger kinds should be handled carefully. The roots of the cacti should be moistened before planting and, after all plants are satisfactorily placed, sprinkle the surface about them. One or more desert animals add considerable life to the desert scene; horned "toads," collared lizards, and small snakes (common desert species), as well as scorpions, will live in the terrarium with a minimum amount of attention. The top of the terrarium should be covered with wire screen rather than the glass plate. The desert group should be kept in a warm place—temperature range 68° to 85° F. is satisfactory.

The Woodland Terrarium

The woodland terrarium offers an unlimited number of possibilities and may include a variety of combinations representing various kinds of habitats. The foundation layer should consist of one part sand, three parts humus, and one part coarse gravel thoroughly mixed; or the gravel may be placed on the bottom of the terrarium and the mixture of sand and humus placed on top of this drainage material. In either case, the soil mixture should be moistened sufficiently so that it will cling loosely together without caking. After the soil mixture has been properly arranged, dampen the roots of the plants, and group them to achieve the desired scenic effect. Those plants whose leaves have a tendency to spread should be centered so that their leaves may grow without touching the sides of the tank, or obstructing a part of the group from view. An instructive as well as attractive terrarium may be arranged with mosses, liverworts, lichens, club mosses, *Selaginella*, and wood ferns. Overcrowding of the terrarium should be avoided; but, if the space is available, the addition of the evergreen plants—twin flower, creeping snowberry, partridge berry with its scarlet berries—is worthwhile and attractive. If a large variety of plants is essential, small or dwarfed plants should be used or, better still, use a larger terrarium. After the planting is completed, the plants should be trimmed, all broken stems and leaves as well as debris removed, and the glass given a final cleaning. The entire group should be sprinkled with a fine spray, the glass cover placed on top, and the terrarium placed in a cool location.

Animals may be included in the woodland habitat; among those to be considered are the common newt, toads, tree frogs, *Ambystoma*, chameleons, small snakes, snails, slugs, beetles, and many others. Toads and salamanders dig under the moss and into the soil, often causing considerable damage to the attractive terrarium; but the opportunity to study their living and feeding habits is well worth this slight destruction. The common newt and the small green grass and garter snakes probably cause the least damage. When chameleons are to be placed in the terrarium, a stout stemmed plant should be included as one of the plants to offer sufficient support for this agile animal.

We have experimented with a new type of basic construction of the woodland terrarium and improved our methods for keeping it in a healthy, growing condition. The basic change we made was to provide for an air space beneath the foundation layer by using a piece of hardware cloth of ½-inch mesh to form a false bottom. The hardware cloth was cut slightly wider and longer than the tank, and the ends and sides were folded under so that at the back it was 1½ inches high and at the front ½ to ¾ inch, thus giving the false bottom a forward slope. A small strip of wire was placed in the angles of the two back corners from the tank bottom to just beneath the plant line to form a channel for the circulation of air from the bottom to the top of the terrarium. On

top of the wire was placed a layer of stone coarse enough to prevent its passing through the mesh. The sand and soil mixture was placed upon the stone layer and the plants arranged. The tank was watered thoroughly, with an excess allowed to collect on the bottom. After the soil had absorbed as much moisture as possible, the excess was pipetted off the bottom of the terrarium through one of the back corners.

(Write for our special bulletin on growing orchids and airplants in terraria.)

The Bog Terrarium

The plants in a bog terrarium require acid conditions and the foundation must supply this need if the plants are to grow and develop normally. There are two possibilities: the bog plants may be planted in a terrarium with a layer of gravel for drainage and covered with a soil mixture of one part Sphagnum and two parts acid soil; or the gravel layer may be covered with a two-inch mat of Sphagnum, using either living or dried material. In either method, the bog terrarium should be thoroughly soaked, with an excess of moisture being allowed to remain in the gravel layer. Where the soil mixture is used as a base, the roots of the bog plants should be wrapped with some Sphagnum; the Venus flytrap and Pitcher Plant should be planted deep, Sundew is a shallow-rooted plant and should be planted accordingly. Where the Sphagnum base is used, the Sphagnum should be pressed firmly around the roots of the plants. The bog terrarium should be covered with a glass top and placed in a cool location.

Any animals which prefer moist surroundings will do well in a bog terrarium. This group includes newts, toads, salamanders, and frogs.

The Semi-Aquatic Terrarium

The planting and planning of a semi-aquatic terrarium is more painstaking than that of the woodland or bog terrarium. Here one is able to combine the aquatic and the terrestrial habitats into one demonstration unit. The aquatic portion of this terrarium may be arranged to give a swamp-like effect, with a shallow pool of water at one end of the tank; the other end is built up a few inches higher, with a bog or woodland base, and planted accordingly with the appropriate materials. A semi-aquatic terrarium may demonstrate a group of insectivorous and bog plants. For instance, Bladderwort may be planted in the water, five Sphagnum on the shore line, and Sundew, Venus' flytrap, Butterwort, and Pitcher Plant placed in the bog region. Dragonfly and damselfly larvae, as well as mud minnows and tadpoles, may be introduced into the water. If the aquatic section of the tank is to represent a tiny aquatic picture, then the depth of the water must be increased to from 6 to 10 inches and the woodland or bog section must be raised correspondingly. The soil line of the terrarium section should be above the water level of the aquatic portion and can be built up with stones and sticks. The aquatic section of this terrarium can be arranged as a regular aquarium planted with Elodea, Vallisneria, Ludwigia, Cabomba, and dwarf water lilies; snails, tadpoles, insect larvae, crayfish, minnows, and sunfish can be used to complete the balance. The terrarium portion should be planted with mosses, lichens, ferns, or bog plants, and the animals for this region can be semi-aquatic, such as turtles, newts, small water snakes, and tree frogs. (Refer also to Turtox Service Leaflet No. 5.)

Notes on Terrarium Care

One should keep in mind that excessive moisture and temperature extremes are the basic causes of terrarium troubles. Mold developing on plants is often the result of too much water; this condition may be checked by dusting the tank lightly with powdered sulphur. Where plant stems are badly damaged, treat them with powdered charcoal. Weak and spindly plants are produced by an excess of heat. When the plants become overcrowded, trim them back and remove some of them if necessary. Remove the cover part of each day if there is too much moisture, or, make a space under it for the circulation of air.

45V13 Turtox Insectivorous Plant Set. Will grow well in bog terrarium or in a very moist woodland tank. Consists of:

1 Pitcher Plant
1 Venus Flytrap
2 Sundews
1 bunch live Sphagnum Moss
1 small bag of bog (acid) soil
1 set of Instructions for planting and care of specimens

Complete as described $7.50

45V15 Turtox Set for Woodland Terrarium. This is one of our most popular sets. It includes the plants and animals found in a moist woodland habitat.

Included are two newts or other small salamanders, one tree frog or small toad, one assortment of woodland mosses, one clump of liverwort, one small native fern, one bag of humus, and one set of directions for planting and caring for the terrarium.

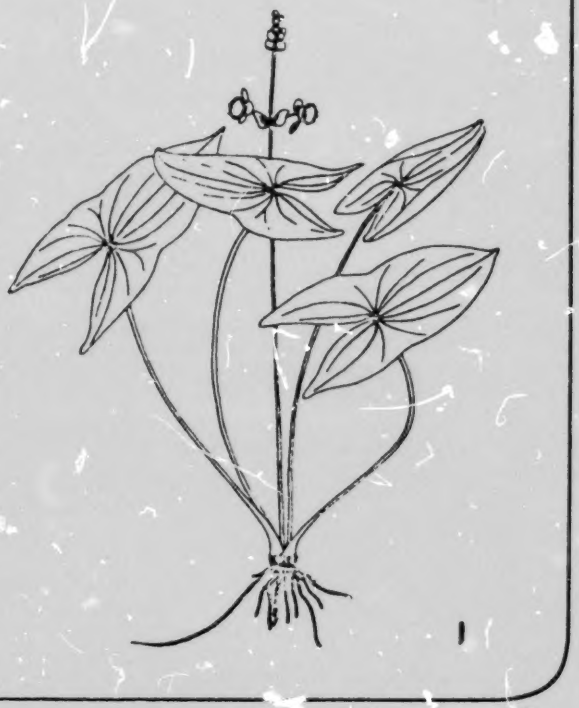
Complete set as described 6.00

All prices are f.o.b. our laboratories and are subject to change without notice.

Living specimens are not sold to students, orders must be placed by the teacher or school.

Identifying Wetland Plants and Animals

Chapter 6
Activity Sheets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CATTAIL
(Typha latifolia)

Fresh Water Marsh

Not Endangered

Did you know that almost every part of the cattail can be eaten? Different parts can be used at different times of the year.

BROADLEAF ARROWHEAD
(Sagittaria latifolia)

Fresh Water Marsh

Not Endangered

Did you know that the tubers of this plant can be boiled and eaten like potatoes?

LONG-BILLED MARSH WREN
(Telmatodytes palustris)

Fresh Water Marsh

Not Endangered

Did you know that the Long-billed marsh wren builds very special kinds of nests? They fasten them to bullrushes two or three feet above the water.

SANDHILL CRANE
(Grus canadensis)

Fresh Water Marsh

Endangered in some areas

Did you know that cranes stay with one mate for life? During mating season, they do some very fancy dances with each other.

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MUSKRAT
(Ondatra zibethica)

Fresh Water Marsh

Not Endangered

Did you know that muskrats build stick houses like those of a beaver? The houses of both animals have underwater entrances.

GOLDEN CANNA
(Canna flaccida)

Fresh Water Marsh

Not Endangered

Did you know that the golden canna lives only in fresh water marshes?

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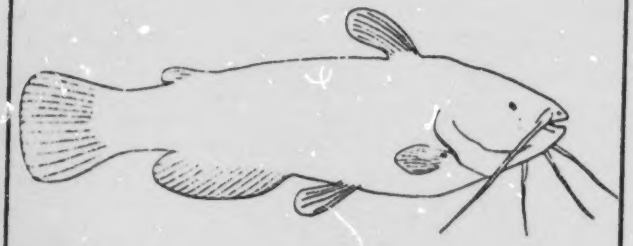

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WOOD DUCK
(Aix sponsa)

Fresh Water Marsh

Endangered in some areas

Did you know that the wood duck was thought to be extinct in 1914? We thought they had been killed off by hunters. But they have been saved. Some were imported from other countries. And it is now illegal to hunt them.

RED--WING BLACKBIRD
(Agelaius phoeniceus)

Fresh Water Marsh

Not Endangered

Did you know that the Red-wing Blackbird nests among cattails and rushes? This bird is found in many other places besides wetlands.

WATER STRIDER
(Gerris sp.)

Fresh Water Marsh

Not Endangered

Did you know that the water strider is nocturnal? That means it is active at night. It preys on other insects that live on the water. What place in the food web do you think the water strider belongs?

BULLHEAD
(Ameriurus melas)

Fresh Water Marsh

Not Endangered

Did you know that bullheads can survive in very shallow water? They do so by burrowing in the mud.

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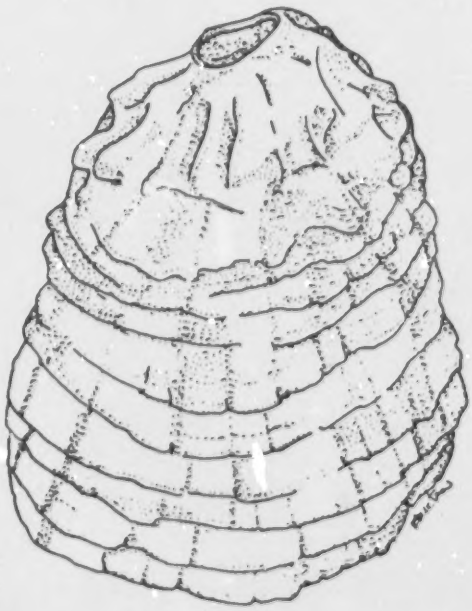

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MARSH FIDDLER CRAB
(Uca pugnax)

Salt Water Marsh

Not Endangered

Did you know that the Marsh fiddler crab is an important link in many food webs? It eats dead organisms from the marsh bottoms. In that way, the dead organisms become part of the food web.

OSPREY
(Pandion haliaetus)

Salt Water Marsh

Rare

Did you know that the osprey is an unusual hawk? It is one of the only hawks that dives into the water for its food.

VIRGINIA OYSTER
(Crassostrea virginica)

Salt Water Marsh

Not Endangered

Did you know that this oyster is commercially important? People like to eat it. So does a small snail called the Oyster Drill. This snail drills through the oyster's shell. Then it sucks out the oyster's flesh.

MUMMY CHOG
(Fundulus heteroclitis)

Salt Water Marsh

Not Endangered

Did you know that the mummy chog helps control mosquito populations in salt marshes? This fish swims along the tidal channels to the upper marsh and feeds on mosquito eggs and larvae.

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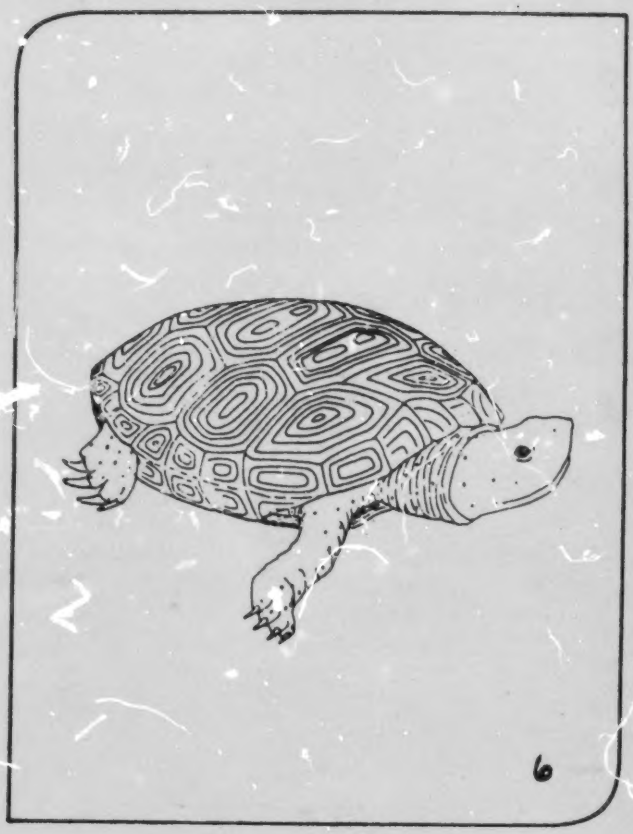
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DIAMONDBACK TERRAPIN
(Malaclemys terrapin)

Salt Water Marsh

Not Endangered

Did you know that the Diamondback Terrapin has a special method for getting rid of salt? It has special glands that remove the salt from the water it lives in.

SALT-MARSH CORDGRASS
(Spartina alterniflora)

Salt Water Marsh

Not Endangered

Did you know that this plant is well adapted to the salt marsh? It has glands that excrete droplets of water. The water contains a lot of salt. In this way, the plant gets rid of a dangerous substance (salt).

SEA LAVENDER
(Limonium nashii)

Salt Water Marsh

Not Endangered

Did you know that sea lavender is one of the few wild flowers that grow in salt marshes? Why do you suppose wild flowers are so uncommon in salty areas?

GREAT BLUE HERON
(Ardea herodias)

Salt Water Marsh

Not Endangered

Did you know that the Great Blue Heron is a patient hunter? It will stand quietly for a long time. It strikes only when some tasty meal swims by.

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WOODY GLASSWORT
(Salicornia bigelovii)

Salt Water Marsh

Not Endangered

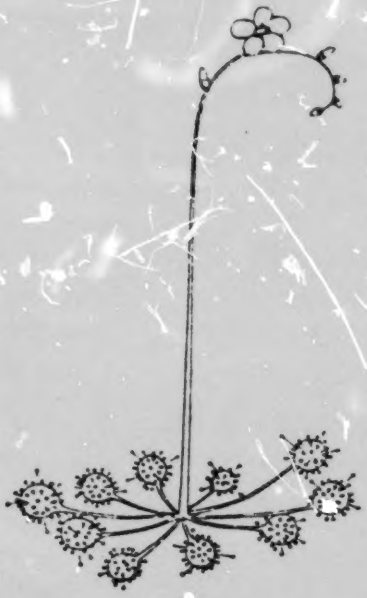
Did you know that this plant is a champion "water-holder"? Its cells store up much more water than most wetlands plants.

SALT MARSH MOSQUITO
(Aedes sollicitans)

Salt Water Marsh

Not Endangered

Did you know that this insect is a serious pest on the east coast? "Ditching" a marsh may eliminate the mosquitoes. But it usually destroys the marshes also. Is that a good exchange?



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SWAMP LOOSESTRIFE
(Decodon verticillatus)

Bog

Not Endangered

Did you know that the swamp loose-strife's roots grow out of the water? They provide the first foothold for sphagnum moss.

SUNDEW
(Drosera rotundifolia)

Bog

Rare

Did you know that sundews capture and eat insects? This is a common way for bog plants to get the nutrients they need.

PITCHER PLANT
(Sarracenia purpurea)

Bog

Rare

Did you know that pitcher plants have stiff hairs on their leaves? They are covered with a sweet sticky juice. Insects are attracted by this juice. When they get into the plant, they can't get back out again. Then the plant digests them.

BOG LEMMING
(Synaptomys cooperi)

Bog

Rare

Did you know that bogs are like islands? Animals can get trapped on them. They get separated from their cousins who don't live on the bog. Over time, they get more and more different from those cousins. That's what has happened to the bog lemming.

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SPHAGNUM MOSS
(Sphagnum sp.)

Bog

Not Endangered

Did you know that sphagnum moss has special cells? They help the moss to absorb lots of water . . . 100 times its own weight. That makes the sphagnum moss perfect for bog life.

AMERICAN LARCH
(Larix laricina)

Bog

Not Endangered

Did you know that the American larch drops all its needles in the fall? That's unusual for a conifer (pine-like tree). The needles collect in the bog. They make the water acidic.

CRANBERRY
(Vaccinium macrocarpon)

Bog

Not Endangered

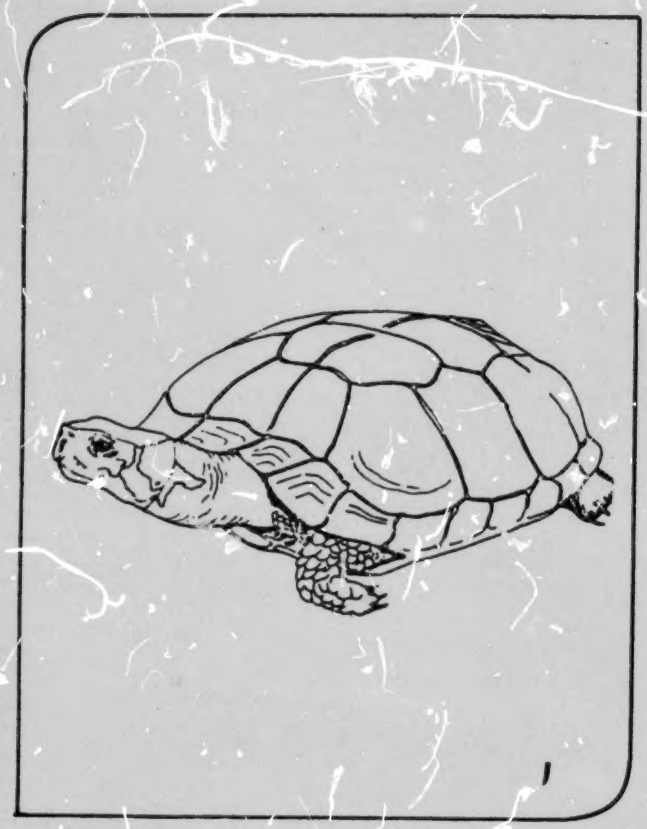
Did you know that cranberries are members of the heath family? They are the only members of the family found in bogs. They are an important commercial product.

ARETHUSA ORCHID
(Arethusa bulbosa)

Bog

Rare

Did you know that this orchid is really a tropical species? Its original home is the wet swamps of the south. There are few nutrients in these swamps. Why do you think this orchid lives in the bogs?



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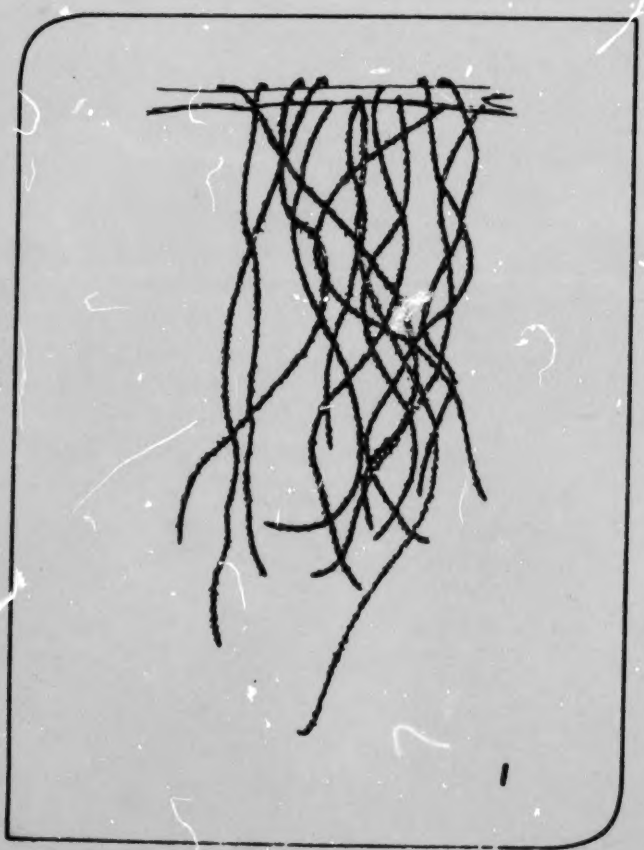

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LEATHERLEAF
(Chamaedaphne calyculata)

Bog

Not Endangered

Did you know that leatherleaf has thick leaves? They help keep moisture in the plant. This is very helpful in the bogs. It's usually very hard for bog plants to take in water.

MUHLENBERG'S BOG TURTLE
(Clemmys muhlenbergi)

Bog

Endangered

Did you know that this turtle was once popular as a pet? Many of its habitats have been drained. Now it's an endangered species.

SWAMP-LILY
(Crinum americanum)

Cypress Swamp

Not Endangered

Did you know that the swamp-lily belongs to a tropical-plant family? It's the only member of that family that lives in the United States.

SPANISH MOSS
(Tillandsia usneiodes)

Cypress Swamp

Not Endangered

Did you know that Spanish moss grows on cypress trees? Birds and reptiles use the moss as a nest-building material.

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GREEN TREE FROG
(Hyla cinerea)

Cypress Swamp

Not Endangered

Did you know that this frog is usually seen only in the spring? At mating time, it darts about and croaks in a very loud voice. The rest of the year it is very quiet and hard to find.

AMERICAN ALLIGATOR
(Alligator mississipiensis)

Cypress Swamp

Endangered in some areas

Did you know that all our alligators were almost killed off? They were killed to get their skins for shoes and purses. Now they are protected by law.

TUPELO TREE
(Nyssa aquatica)

Cypress Swamp

Not Endangered

Did you know that this tree lives only in deep swamps? The soil around it has to be flooded at least part of every year.

ARROW-ARUM
(Peltandra virginica)

Cypress Swamp

Not Endangered

Did you know that Arrow-arum seeds contain a lot of oxalic acid? That gives them an awful taste. Only wood ducks eat them regularly.

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IVORY BILLED WOODPECKER
(Campephilus principalis)

Cypress Swamp

Endangered

Did you know that the Ivory-billed woodpecker eats insect larvae? They eat only the larvae that live in dead cypress trees. The cypress trees have to have been dead for exactly three years.

SNAKEBIRD
(Anhinga anhinga leucogaster)

Cypress Swamp

Not Endangered

Did you know that the Snakebird has a neck 25 cm long? It can "fly" under water, darting this way and that to catch fish.

COTTONMOUTH WATER MOCCASIN
(Agkistrodon piscivorous)

Cypress Swamp

Not Endangered

Did you know that the cottonmouth is one of the few poisonous water snakes?

BALD CYPRESS
(Taxodium distichum)

Cypress Swamp

Rare

Did you know that the cypress has a special way of getting oxygen? Most plants get it from air spaces in the soil. But cypress roots are under water. It doesn't get its oxygen in the usual way. We don't yet know how the cypress does get the needed oxygen.

Wet Lands in the Wetlands

Chapter 7
Activity Sheets

Activity Packet 7
Data Sheet 1

Data Sheet for the Soaker Tester Tests

Material	A Weight of Soaker-Tester (dry)	B Weight of Soaker-Tester (wet)	C Weight of Water (B-A)	D* Percentage of Water in Material (C÷A) x 100
Sphagnum moss moss				
Peat moss				
Sod				
Sand				
Rock				

*This is not the most exact way to find the percentage of water. Your teacher may give you another way to calculate this percentage.

SUMMARY QUESTIONS

In this activity you learned about the "water-holding power" of different materials. Suppose you poured a jar of water over each of the materials listed below. How much water would each one soak up? For each material choose one of the following answers:

	lots	some	none
Sphagnum moss	lots	some	none
Peat moss	lots	some	none
Sod	lots	some	none
Sand	lots	some	none
Rock	lots	some	none

Activity Packet 7

Data Sheet 2

a. There was no flooding in drawing #1 because _____

_____

_____

_____

b. There was flooding in drawing #2 because _____

_____

_____

_____

c. In drawing #3, there would/would not (choose one) be flooding in Holsum City because

_____

_____

_____

_____

d. In drawing #3, there would/would not (choose one) be flooding in Jestertown because

_____

_____

_____

_____

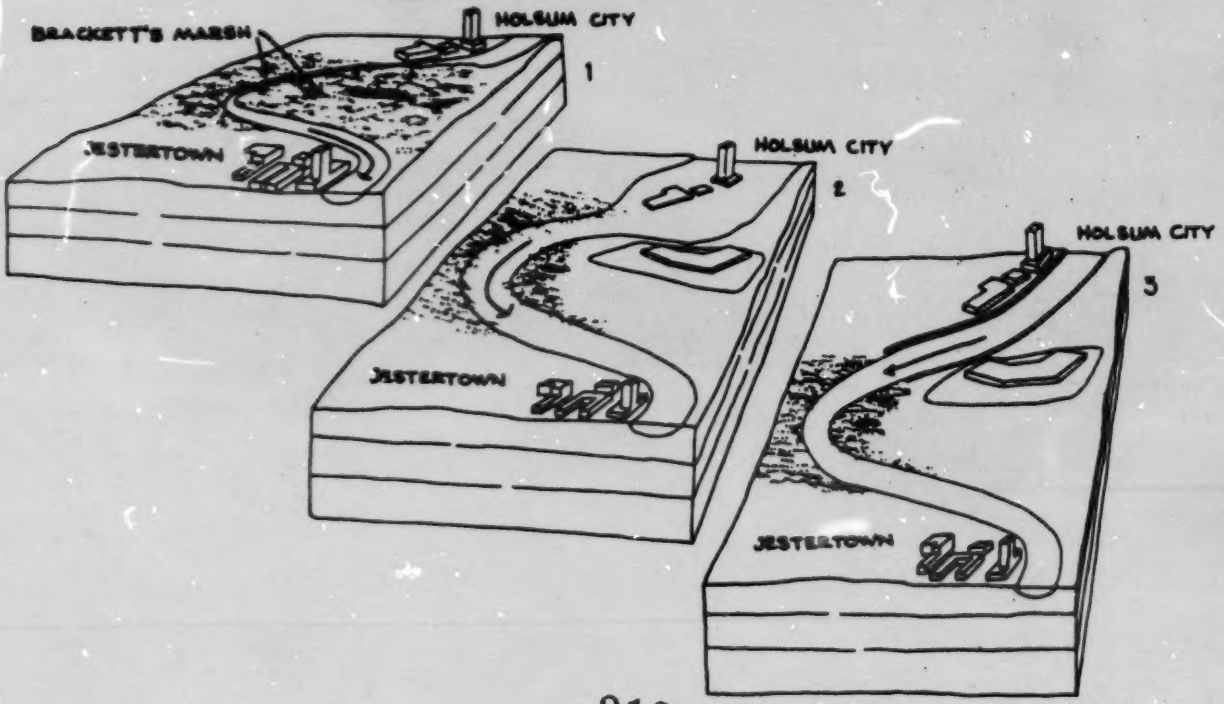
Activity Sheet 7-1

Floods on the Snake River

The three diagrams below show a section of the Snake River and the area around it. Each spring rains cause the Snake River to become very full. At one time (drawing #1) floods were rare in Holsum City, no matter how much rain there was. Why do you think that was? Write your answer in the space provided on Data Sheet 2.

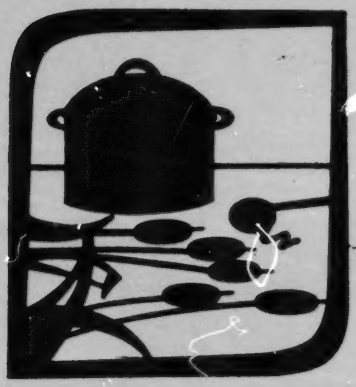
A few years ago, a large shopping center was built across the river from Holsum City. Brackett's Marsh was filled and covered with asphalt to build this shopping center. The next few years, Holsum City was flooded every year. Why do you think that was?

Recently large cement dikes were built on both sides of the Snake River at Holsum City. What effect do you think this will have on flooding in Holsum City? What effect do you think this will have on flooding in Jestertown? Explain how you got your answer in each case.



Wetland Dinner

Chapter 8
Activity Sheets



Activity Packet 8

Wetland Recipes

Duck Potatoes

The arrowhead plant gets its name from the shape of its leaves. The part of the plant we want are the potato-like growths on the roots. They are known as tubers. They should be collected late in the fall. The rest of the plant has died by this time. All that's left should be brown stalks. Pull up the plant and cut off the tubers.

You can use arrowhead tubers in almost any way you use an ordinary potato. You should begin by boiling the unpeeled tubers until they are tender (about 30 minutes). Then, peel them and serve them with butter. Or use them in any potato recipe. Duck Potato Pancakes are one example.

Chop two cups of cooked arrowhead tubers in a bowl. Add the following:

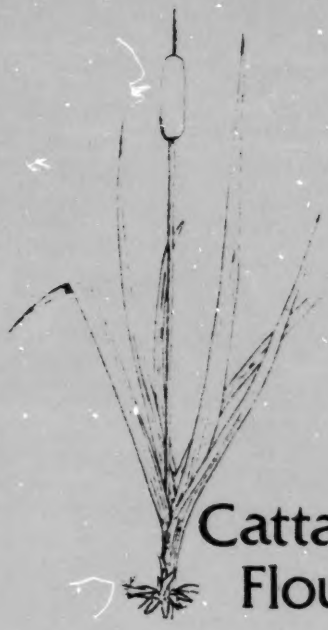
1 raw egg
1 tsp salt
1 tsp sugar
1 cup of flour
2 tbsp vegetable oil

Mix thoroughly and cook as you would any kind of pancake. They can be served with maple syrup or fruit preserves. This recipe is good for about six people.

Cattail Soup

Wetlands people used cattails at every season of the year. In the spring they ate the tender young shoots as a vegetable. During the summer they used the pollen from the cattail heads or the dried underground parts as a flour. In the fall, the fleshy underground stems (rhizomes) were collected and cooked. They can also be used in the same way we used arrowhead tubers. Our recipe will make use of the stalks that appear in the spring.

You'll need about 50 cattail stalks, each about 6 inches long. This recipe serves six people. Remove the green outer part of the stalk. Find the soft white pulp inside. Boil or steam these pulps until they are tender (about 30 minutes). While waiting for



Cattail Flour

the pulps to cook, combine the following in a separate pan:

3 tbsp butter (melted)
3 tbsp flour
1 1/2 tsp salt
1 tsp pepper

Add 3 cups of milk slowly and with mixing to this mixture. Warm over a low heat until the mixture begins to thicken. Then add 1 tsp of lemon juice and the cooked and drained cattails. Mix thoroughly and keep warm until ready to serve.

The cattail's creeping roots are called rhizomes. A kind of flour can be made from this part of the plant. Peel the rhizomes to their starchy core. Then crush them in a sieve submerged in a water-filled pan. With the sieve, strain out the fibers. Let the flour settle to the bottom of the water. Drain off the water. The flour is ready for use, wet or dry.

Use this cattail flour as a substitute for regular flour in any favorite recipe.

Cossack Asparagus with Cheese Sauce

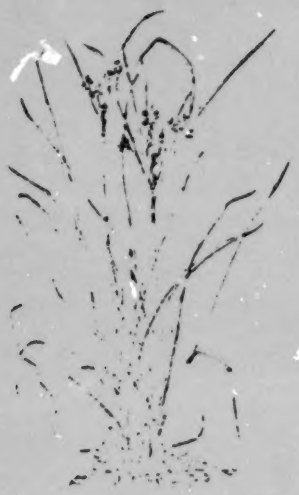
6 cups young cattail plants (use tender white shoots or the white pulp inside a stalk)
3 tbsp butter or margarine
3 tbsp flour
2 cups milk
1/2 tsp salt
dash of pepper
1/2 cup shredded cheddar cheese

Steam or boil cattails for ten minutes. Melt butter or margarine. Stir in flour. Then add milk gradually. Stir in cheese until smooth. Salt and pepper to taste. Pour over cattails. Serves 6.

Chufa Muffins

Chufa is also known as nut-grass. It is a common weed in many fresh-water areas. Like the arrowhead, it produces tubers. These are the parts most often used in recipes. The method for making flour from the chufa tubers can also be used for making flour from arrowhead tubers, cattail roots, and bulrush plants.

Locate the tubers on a chufa plant. They grow on the roots of the plant. They may be a long distance from the plant itself. Cut off the tubers. Wash them well and boil them for about half an hour. You should change the water twice during this period. Drain the tubers. Then heat them on a cookie sheet



in a warm (250°) oven for about an hour. They will become crisp or brittle. Here's how to tell when they're done. Remove a tuber. Hit it with the back of a spoon. See if it will break apart. If it does, the tubers are ready.

When they are done, wrap the tubers inside a piece of cheesecloth. Pound them with a wooden mallet or rolling pin. The pieces will get smaller and smaller. Then use the rolling pin to reduce them to a finer powder. The final product will not be as smooth as regular white flour. But it will work just fine for baking.

Combine the following in a large mixing bowl:

1 cup chufa flour
1 cup white or whole wheat flour
1 tbsp baking powder
1 tsp salt
2 eggs (well beaten)
1 tbsp honey

Add enough water to this mixture to give a dough that looks like oatmeal.

Put 1/2 tsp of vegetable oil into each section of a muffin pan. Add a heaping tablespoon of dough to each section. Bake in a 400° oven for about 15 minutes. The top of the muffins should be a golden brown when done. Serve hot with butter.

Marinated Kelp (Sunomono)

Kelp is a common kind of seaweed. It is found throughout the world. It usually grows close to the beach. Seaweed is a part of the diet for people in many countries. It is especially popular in China and Japan.

Seaweed can be harvested at low tide. You may live too far from the coast. If so, you may be able to buy seaweed. Some grocery stores specialize in Japanese or Chinese foods. The food requires almost no preparation. It should be rinsed well. For the recipe below, it should be chopped into bite-sized pieces. If you collect your own seaweed, you can eat it raw, dried, or cooked. To cook the seaweed, put it in boiling water for about half an hour.

Marinated kelp can be served as a salad at the beginning of your Wetlands Dinner. It is a traditional Japanese food known as sunomono. Begin by blanching about four cups of kelp. To blanch something, heat a large pot of water to boiling. Drop one cup of the kelp into the water for about 2 minutes. Then remove the kelp with a slotted spoon. Let it drain on a piece of paper towel. Blanch the rest of the kelp, one cup at a time.

Mix the following in a large bowl:

1 cup vinegar
2 tbsp soy sauce
1/2 cup sugar
1 tsp ginger
1 tsp salt

Add the blanched kelp to the mixture and cover. Place in a refrigerator for at least 24 hours. Stir the mixture from time to time. The kelp should be kept covered with sauce. Before serving, remove the kelp from the marinade sauce. Lay out on a salad plate. The recipe should serve about eight.

Clam Pie

The clam pie you make here begins like any two-crust fruit pie. Obtain a box of pie crust mix. Read the directions on the pie crust box. They will tell you how to make the crust or follow the recipe for two-crust fruit pie in a recipe book. Use half of the crust to line a 9-inch pie plate. The filling for the pie is made as follows:

Cut a half pound of salt pork into small pieces. Fry this pork until it is crisp. Remove the salt pork from the frying pan with a slotted spoon. Let it dry on paper toweling. Slice three medium-sized potatoes, and one pint of clams (with the juice in which they are packed) to the pie plate prepared above. Add a few pieces of butter. Season with salt and pepper as desired. Cover the whole with the other half of the pie crust. Crimp the two crusts together. Poke a few holes in the top crust. This will allow steam to escape. Place the pie in an oven pre-heated to 400° for 10 minutes. Then, reduce the heat to 350°. Bake for an additional 20 minutes. This pie will make eight small servings.

Cranberry Sauce

Cranberries are a very common bog plant. In some states, cranberries are a major commercial product. Cranberry sauce is a wetlands food familiar to almost everyone. It is part of nearly every Thanksgiving dinner. Here's an easy way to make cranberry sauce.

If you live near a bog, collect your own cranberries. If not, buy whole cranberries in a local supermarket. You will need about a pound for this recipe. Wash the berries well. Pick out any spoiled or damaged ones. Combine two cups of sugar with two cups of water in a pan. Heat for 5 minutes. All of the sugar should dissolve. Add the clean cranberries to the sugar water. Simmer for an additional 5 minutes. Sometimes a soapy-looking foam will form. Skim this off with a wooden spoon. Allow to cool. Now the sauce is ready to eat. This recipe will serve about 10 people.

Wetland Arts and Crafts

Chapter 9
Activity Sheets

Activity Packet 9

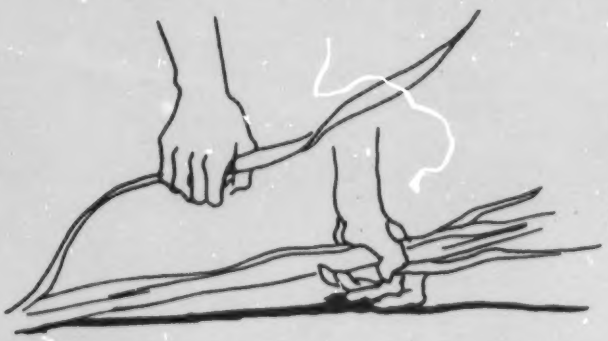
Wetlands Arts and Crafts

A Cattail Mat

1. You will need about 20 cattail stalks for this project.
2. Cut the root off each stalk.
3. Separate the leaves.

STEP 2

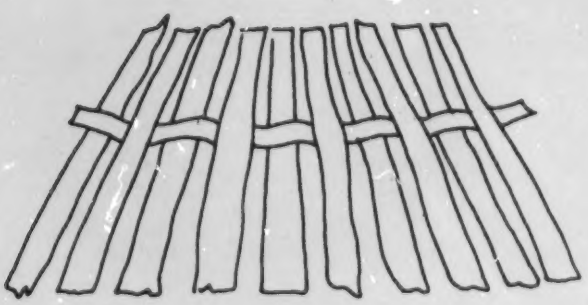
STEP 3



4. Place 20 leaves next to each other on a table top.
5. You will weave 20 more leaves through these. Begin at the center. Weave a leaf over and then under.

STEP 4

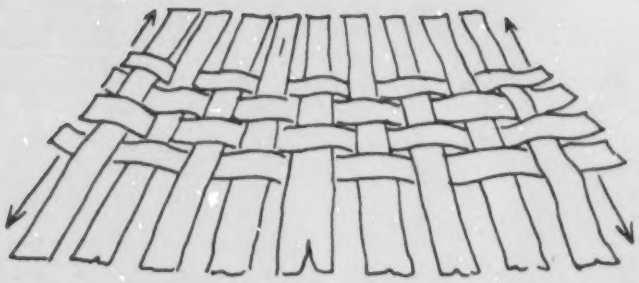
STEP 5



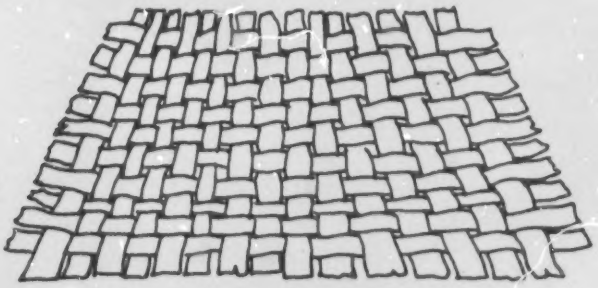
6. Work your way out in both directions from the middle.

7. Leave about an inch on all sides as a fringe.

STEP 6

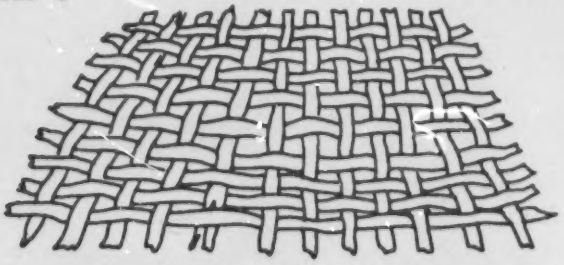


STEP 7



8. Push the leaves as close together as possible. As they dry, they will shrink and pull away from each other.

STEP 8



Cattail Toys

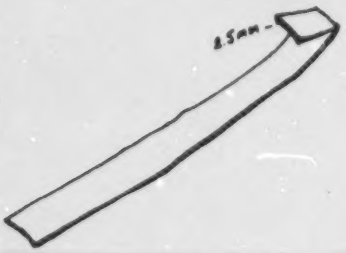
You will need separate cattail leaves for each of the following toys. Cut the root from a cattail stalk and separate the leaves (as in the first project, steps 2 and 3).

Cattail Boat

1. Start with a single leaf. Fold it 2.5 cm from the end.

2. Wrap the rest of the leaf around this fold. Tie the boat together with a string.

STEP 1



STEP 2

3. You can make a larger boat by adding more leaves. Use a wetlands flower or fruit for the boat's mast. Or make a sail from some wetlands material.

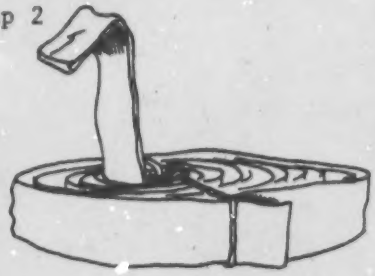
Cattail Duck

1. The duck's body is made just like the boat.

2. The duck's head and neck are made from a short piece of cattail leaf, bent at one end.

Step 1

Step 2



Cattail Doll

1. Begin with 5 pieces of cattail leaf, each about 25 cm long. Bend each in the middle and put them together.

2. Tie the bundle together, about 2.5 cm from the top. You can use string. Or you can find a wetlands material to use in place of string.

3. Cut four pieces of cattail leaf, each about 10 cm long. Push them through your bundle from (2) above.

4. Tie the bundle again, just below the "arms" you just made.

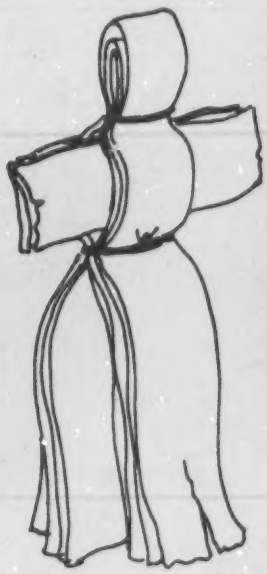
5. You may want to paint in a face, using the pen or brush you can make from wetland materials.

Step 1

Step 2

Step 3

Step 4



Wetlands Pens and Brushes

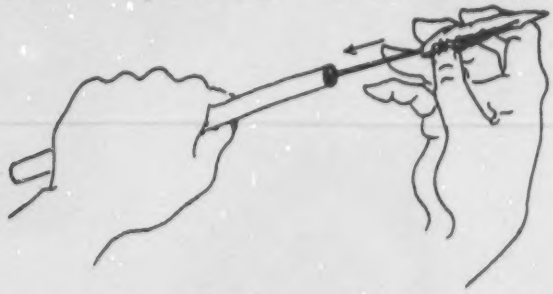
1. Reeds are common in wetlands. The stem of a reed is usually a hollow tube. We can use this tube to make either a pen or a brush.

2. To make the pen, split the reed in half, down the middle.

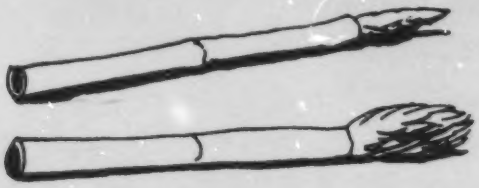
3. Then trim one end to make a point.

4. Dip the pointed end in ink. Write a short story or poem about the wetlands using your pen.

5. To make a brush, use a complete reed. Look for something in the wetlands to use as the end of the brush. The tassle or flowering stalk on one of the grasses would work fine. Push the tassle into the reed so that only about 2.5 cm of the tassle sticks out.



6. Your paint brush may have a narrow tip or a wide tip. Which one is good for writing a story? Which one for painting a picture? How can you make each kind?



7. Make a watercolor painting using your wetland brush.

Molds of Wetlands Objects

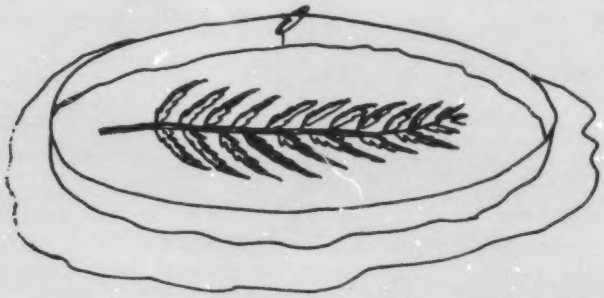
1. Plaster casts can be used as paperweights or as decorations. Many things in the wetlands will make good plaster casts: leaves, ferns, seed pods, tree bark, animal bones and animal tracks. The following method is good for all of these except the last (animal tracks).

2. Flatten a piece of modeling clay on a table top. A rolling pin will make a good flat surface.

3. Place the object you've collected on top of the clay. Press it down carefully but firmly. You are making an image of the object in the clay.

4. Carefully remove the object.

5. Cut a piece of cardboard 5 cm wide and long enough to go around the piece of clay. Make a collar of this cardboard and hold it together with a paper clip.

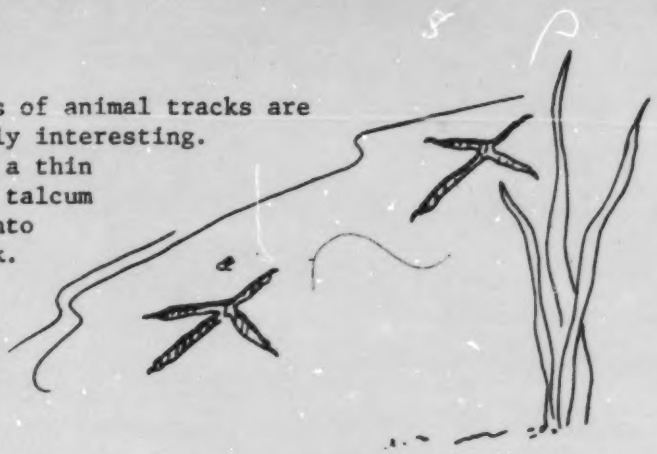


6. Make a mixture of plaster of Paris in a metal coffee can. Begin with enough dry plaster of Paris to fill your clay mold. Then add water slowly to the plaster of Paris. Stir the mixture continuously so that a smooth paste is formed. The final mixture should look like very thick soup.

7. Pour the mixture into the clay mold and allow to set until hard (about an hour). Then remove the cardboard collar.

8. If you like, paint your final product.

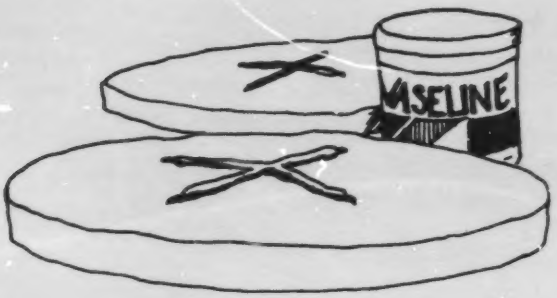
9. Casts of animal tracks are especially interesting. Sprinkle a thin layer of talcum powder into the track.



10. Choose the best track you can find. Sprinkle a thin layer of talcum powder into the track.

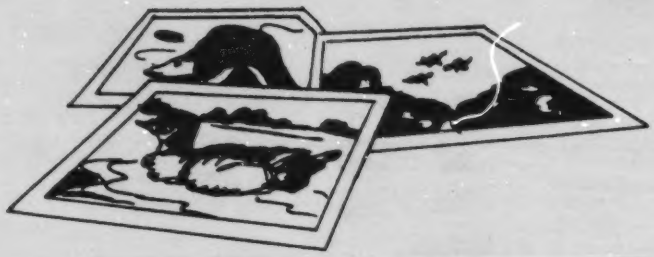
11. Prepare some plaster of Paris as directed in (6) above.

12. When the plaster has hardened, remove it from the track. From this point, you can use the track mold you've just made as you would any other object for making a new mold. Just follow directions (2) - (8) above. Before step (7), you will need to cover your track mold with a coat of vaseline. This will prevent the old plaster of Paris from sticking to the new plaster of Paris.

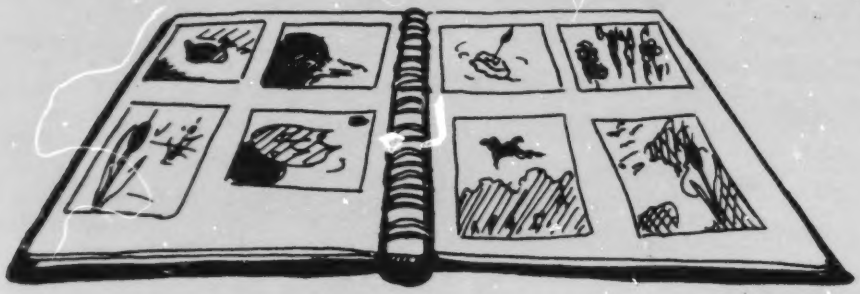


Photography

1. Anyone can take a good photograph today. You should have no trouble borrowing a simple camera to use in taking wetland photos. One project would be to do a photo album of a local wetland area.



Limit yourself to one 20-exposure roll of film. Then take 20 pictures that will show what this wetland is like. You could make a poster about your wetland using these photographs.



2. A second project can be a Portrait of a Wetland Organism. Professional photographers often take many photographs of a single person. You can do the same with a wetland plant or animal. Choose an organi and then photograph it:

From far away...	Looking down on it...
Looking up at it...	In dim light...
While it's still...	In bright light..
Close up	While it's moving...

. . . and so on

Pipes of Pan

1. Pan was a god in Greek mythology. He is often pictured playing music on a set of pipes. You can make these pipes using wetland materials.

2. You'll need two kinds of materials: (a) hollow tubes and (b) twine. The hollow tubes can come from reeds, bamboo stalks, or any other plant stem that is hollow.

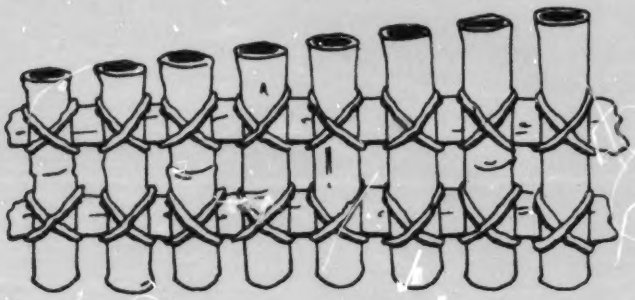
3. The twine can be made from tough roots, bark, vines, or heavy string or twine from the store.

4. You can make as many pipes as you like. The more you have, the more tunes you can play. With 8 pipes, you can have a complete musical scale. The tone produced by a pipe depends on its length. Here are the lengths you will need for an 8-pipe set:

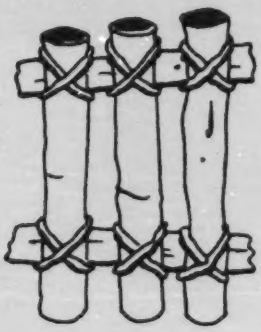
Middle C:	17 cm	G:	11 cm
D:	15 cm	A:	10 cm
E:	13 cm	B:	10.5 cm
F:	12 cm	High C:	9.9 cm

5. Cut each pipe just slightly longer than the measurements given. Close off one end of the pipe with a plug of modeling clay. With the plugs in place, the pipes should be exactly the right length.

6. The pipes should be attached to each other. Tie the 8 pipes on top of two cross-pieces. Attach each pipe to both crosspieces by means of twine.



7. Your pipes are now ready to play. To make a tone, blow across the top of each pipe.

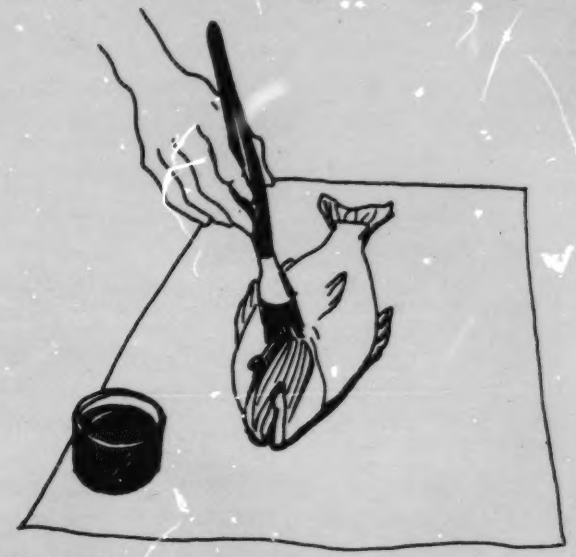


8. A simple three-pipe set can be made using only the D, G, and middle C pipes. The middle C pipe should be just shorter than the measurement given above. Make it 16 cm. Directions for the other two pipes are exactly the same as in (4) and (5).

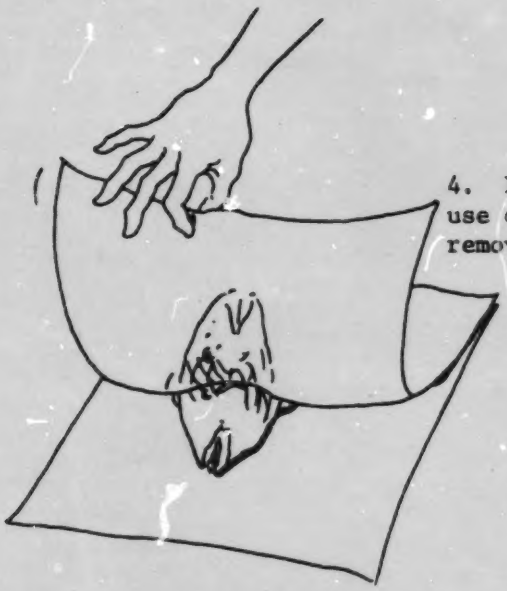
Fish Prints

1. Fish prints are easy to make. They are popular in Japan, where they are called gyotaku. You should begin with a fresh fish. Clean it well by washing it in running water. Be sure to get off all the slimy mucous covering that lets the fish slip easily through the water. Blot it dry with paper toweling.

2. Now you are ready to paint the fish. Lay it flat on a large piece of poster paper. Then cover the fish with a thin coat of paint or ink. You can use poster paint or any kind of ink that is used in printing.

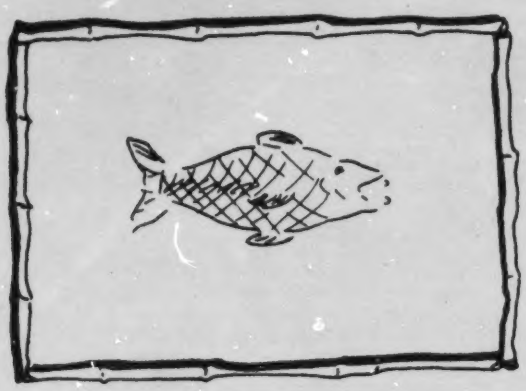


3. Before the paint begins to dry, carefully piece a second piece of poster paper on top of the fish. Gently press the paper down on the fish so that the paint from the fish is transferred to the paper. You have to use great care here so that the paint is not smudged as you press down.



4. Finally, remove the paper from the fish. Again, use care so that you don't smudge the paint as you remove the paper.

5. You could make a frame for your fish print by pasting the print to a piece of plywood. The border for the frame could be made from reeds, or other parts of wetland plants.



Human Life in the Wetlands

Chapter 10
Activity Sheets

Activity Packet 10

Data Sheet 1

A. Here is how the people in the city use the river:

This is good/bad because:

1. _____ _____
2. _____ _____
3. _____ _____

B. Here is how the people in the city change the river:

This is good/bad because:

1. _____ _____
2. _____ _____
3. _____ _____

"Good" and "bad" may not be the correct words to use here. What is "good" in one person's opinion might be "bad" in another's. Choose an example from one of the two lists above to show what this means. For what reasons might two people have given opposite judgments in the example you picked? List as many reasons as you can:

Example:

Reasons for differences of opinion:

Now look back at lists A and B again. In the spaces below, give exactly the opposite answer for each item. Where you wrote "good" above, write "bad" below, and vice versa. Try to find a good reason for each of the new answers you've given.

A.	Here is how the people in the city use the river:	This is good/bad because:
	1. _____	_____
	2. _____	_____
	3. _____	_____
B.	Here is how the people in the city change the river:	This is good/bad because:
	1. _____	_____
	2. _____	_____
	3. _____	_____

Activity Packet 10

Data Sheet 2

1. List the ways in which Cochin's family used the marsh. After each use, tell one reason that might be thought of as a "good" use for humans. Then, tell one reason that same use might be thought of as "bad" for humans. Finally, do the same for the marsh itself.

Use	Why this would be "good" for humans	Why this would be "bad" for humans	Why this would be "good" for the marsh	Why this would be "bad" for the marsh

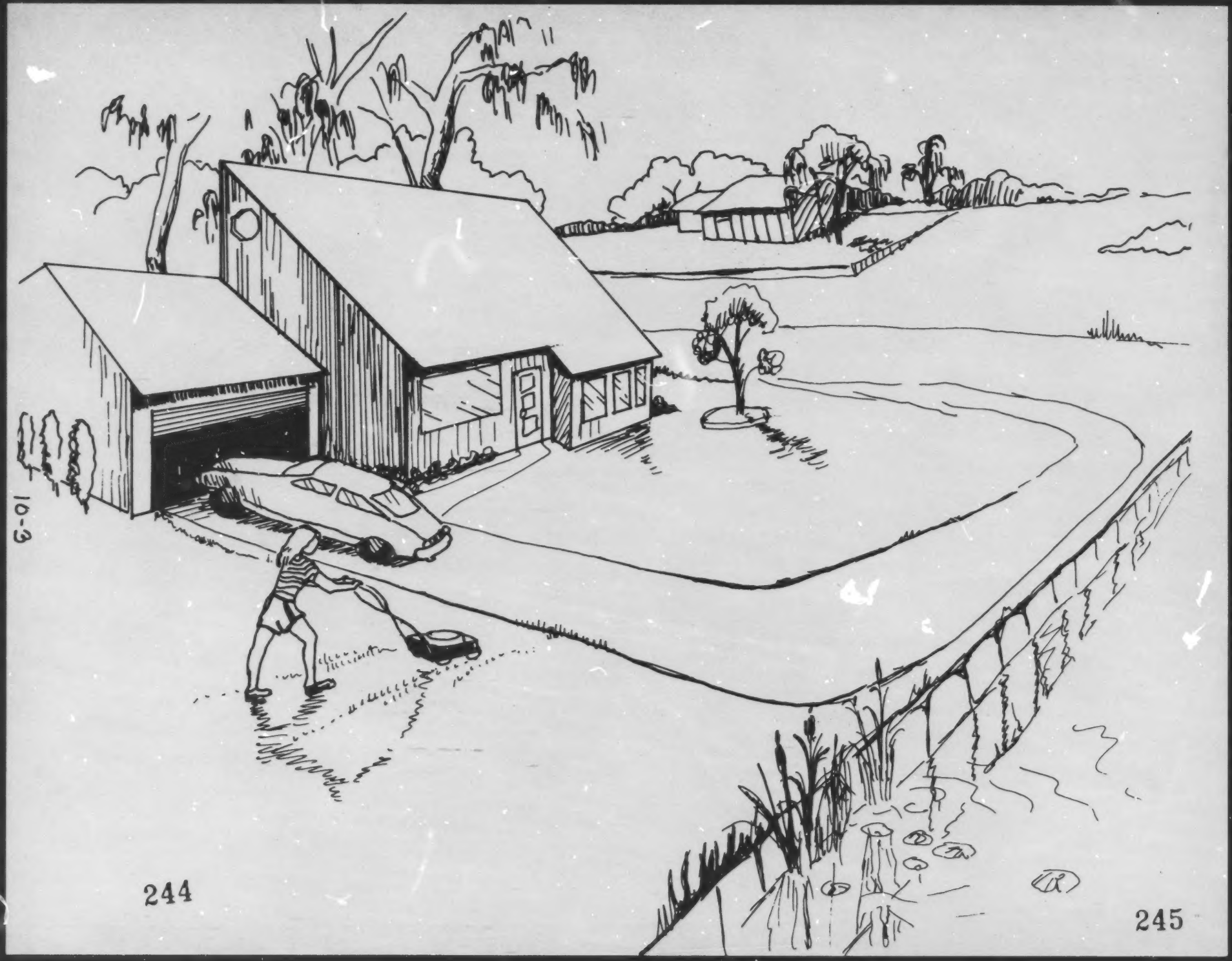
2. List the ways in which Angela's family uses the marsh. After each use, tell one reason that might be thought of as a "good" use for humans. Then, tell one reason that same use might be thought of us "bad" for humans. Finally, do the same for the marsh itself.

Use	Why this would be "good" for humans	Why this would be "bad" for humans	Why this would be "good" for the marsh	Why this would be "bad" for the marsh

3. Why are the words good and bad used only with quotation marks ("good" and "bad") in this exercise?

4. What difference do you see in the ways these two families interact with the marsh? How can you explain these differences?

5. Look back at the first sketch in the BACKGROUND section of this activity. What, if anything, does that sketch have to do with these two stories?



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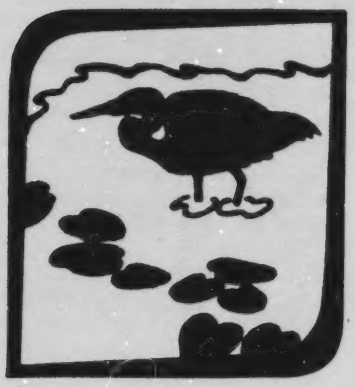
Chapter 11
Activity Sheets



Activity Sheet 11-1

Find a Wetlands Expert

There is usually someone in the government who knows about wetlands. Here are some places you can look:

1. City or County Engineer's Department
2. City or County Water Department
3. State Department of Natural Resources
4. City or State Environmental Protection Agency

Contact each of these agencies. Ask for the person who knows about wetlands. That person may be able to help you. Or he or she may suggest someone else to contact. It may take a while to find someone. You may have to go from one place to another. But don't give up!

Many federal agencies are concerned with wetlands. There may be a regional office for one of these agencies in your area. The ones you should look for include the following:

1. Department of Agriculture
   - Forest Service
   - Soil Conservation Service

2. Department of Commerce
   - National Marine Fisheries Service

3. Environmental Protection Agency

4. Department of the Interior
   - U.S. Fish and Wildlife Service
   - Heritage Conservation and Recreation Service
   - National Park Service
   - Bureau of Land Management
   - Office of Water Research and Technology
   - Bureau of Reclamation
   - U.S. Geological Survey

5. Department of the Army
   - U.S. Army Corps of Engineers

Many industries have experts on wetlands. Many of the things that industries do damage wetlands, accidentally or on purpose. They often hire someone to help them reduce this damage. Make a list of the major industries in your community. Then call each one. One of these companies may be able to send an expert to your class.

There are many private organizations that are also concerned about the protection of the environment. They are also interested in wetlands. Some which you should inquire about include:

1. Sierra Club
   530 Bush St., San Francisco, CA 94108

2. Alliance for Environmental Education
   1619 Massachusetts Ave. N.W.
   Washington, D.C. 20036

3. The Conservation Foundation
   1717 Massachusetts Ave. N.W.
   Washington, D.C. 20036

4. Defenders of Wildlife
   1244 19th St. N.W.
   Washington, D.C. 20036

5. Environmental Action Coalition
   156 Fifth Ave. Suite 407
   New York, NY 10010

6. Environmental Action
   1346 Connecticut Ave. N.W. Suite 731
   Washington, D.C. 20036

7. Environmental Defense Fund
   475 Park Ave. S.
   New York, NY 10016

8. Friends of the Earth
   124 Spear St.
   San Francisco, CA 94105

9. Isaak Walton League of America
   1800 N. Kent St. Suite 806
   Arlington, VA 22209

10. National Audubon Society
    950 Third Avenue
    New York, NY 10022

11. National Parks and Conservation Association
    1710 18th St. N.W.
    Washington, D.C. 20036

12. National Wildlife Federation
1412 16th St. N.W.
Washington, D.C. 20036

Activity Sheet 11-2

Questions for the Guest Speaker

Your guest speaker will probably have some good ideas about what to talk about. He or she may ask for some suggestions. You should have a few questions that you would like to have answered. The following are some of the most important. You can add others of your own:

1. Why is this wetland area important to our community? What would happen if the wetland were no longer there?

2. Why do some people want to drain or cover up this wetland? What benefits would there be in doing that?

3. What is <u>your</u> opinion about this wetland? Should we allow it to be changed? Or should it be preserved just as it is?

4. Are there any controls on the things that humans can do in this wetland? If so, what are they? If not, explain why there are no controls.

What do you Think About the Wetlands?

Chapter 12
Activity Sheets

Activity Packet 12

People Interviewing

Interviewer: _____

Card Holder: _____

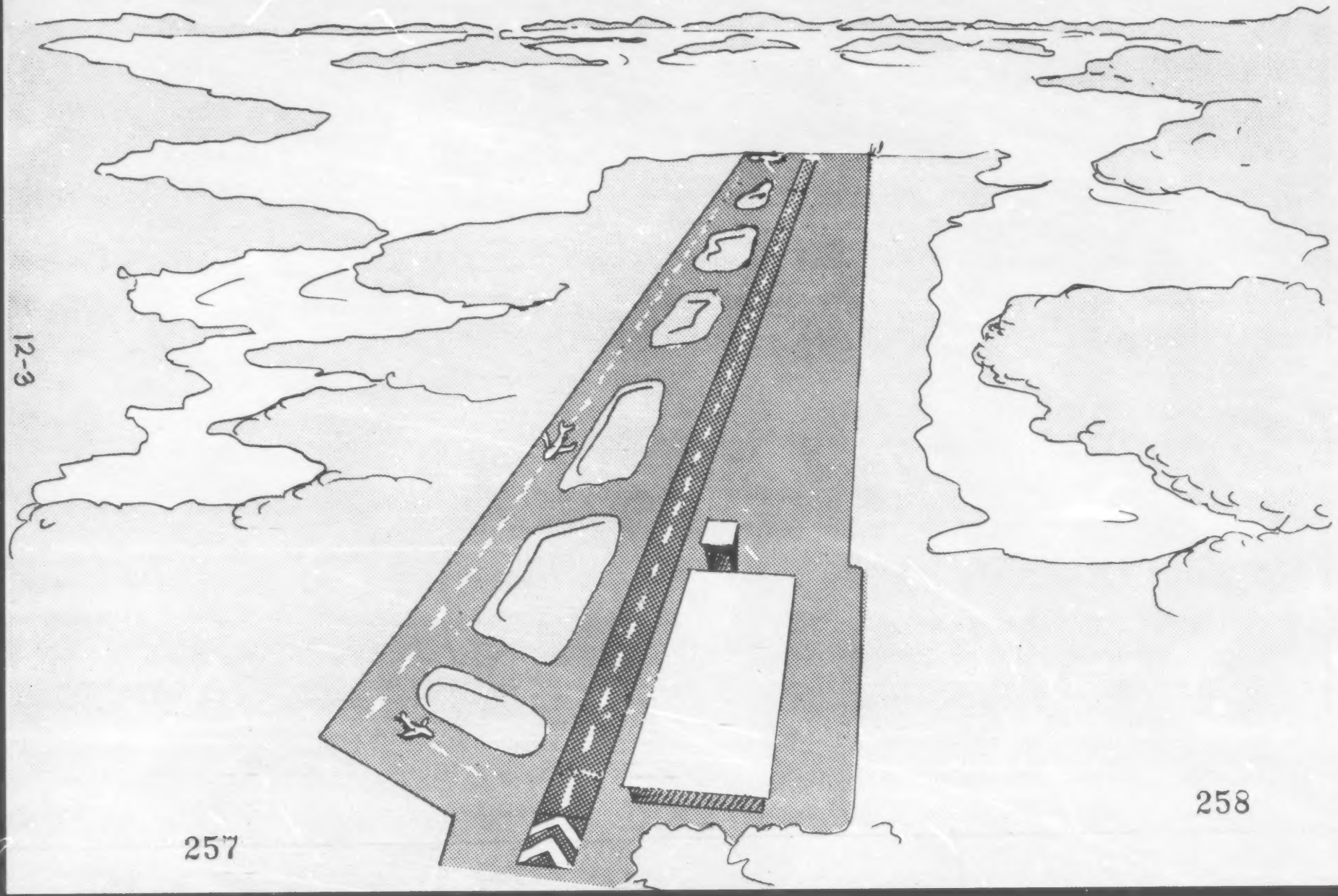
Date: _____

	Men						Women						Girls						Boys						
Card	1	2	3	4	5	Total	1	2	3	4	5	Total	1	2	3	4	5	Total	1	2	3	4	5	Total	Grand Total
Duck Hunter																									
Venus Flytrap																									
Spider Eating Fish																									
Frog on Lily Pad																									
Air Strip On Marsh																									
Alligator																									
House on Marsh																									
Cypress Swamp																									
Fill Dirt In Marsh																									
Alligator Shoes and Furs																									

12-1

SPIDER EATING FISH

AIR STRIP ON A MARSH



12-3

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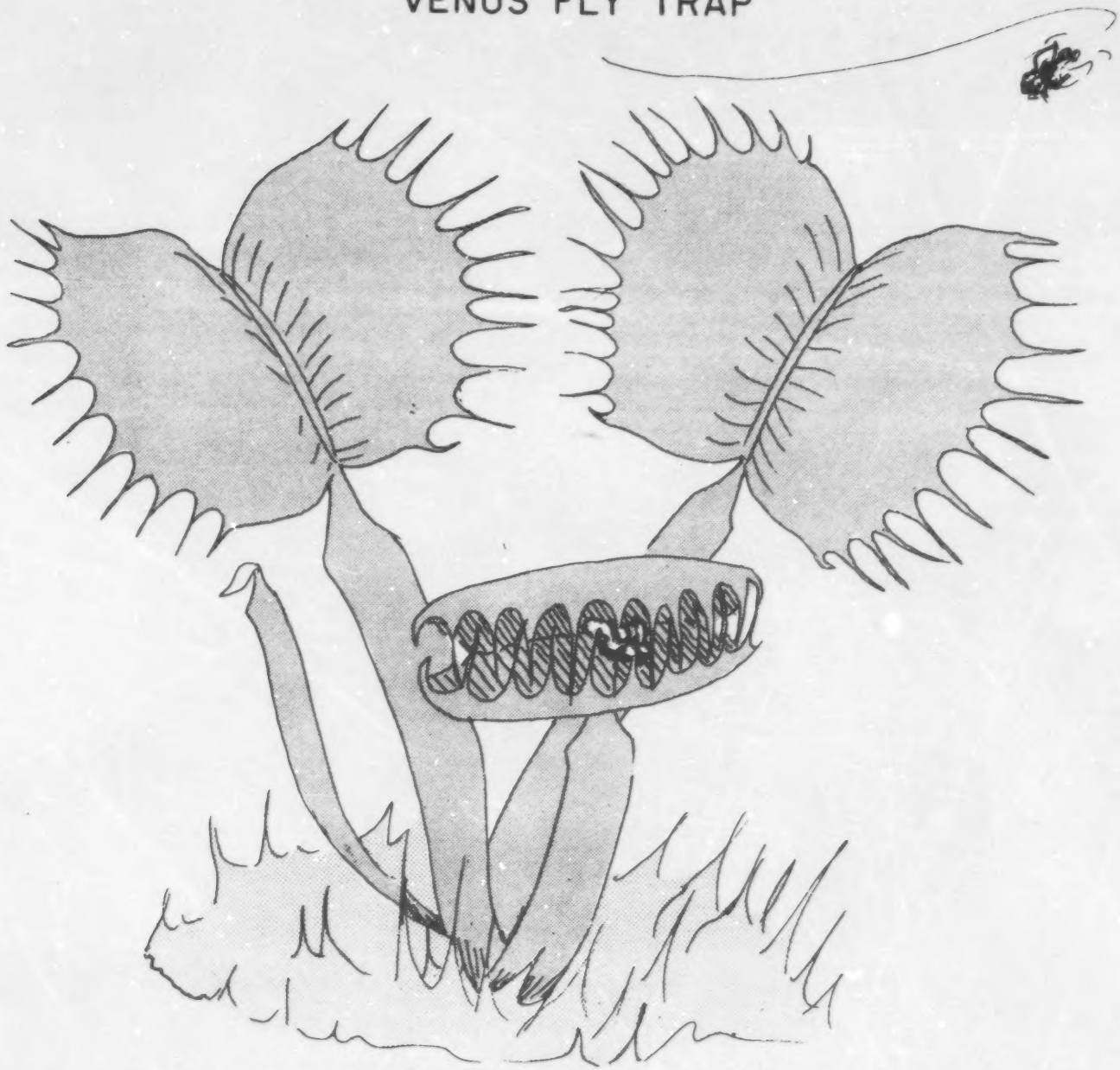
VENUS FLY TRAP



12-4

DUCK HUNTER IN A MARSH

12-5

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FILL DIRT IN A SWAMP

12-6

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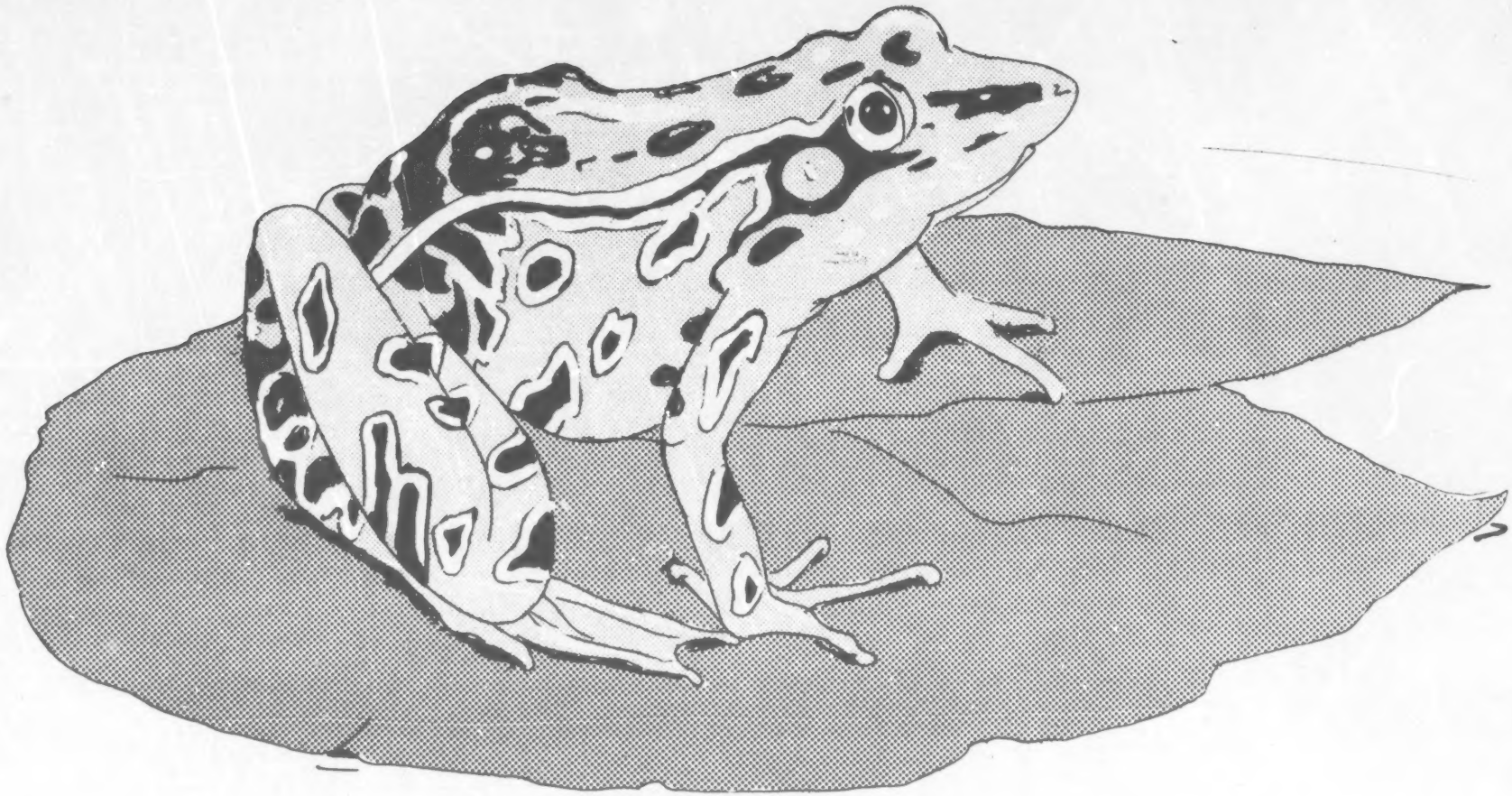
FROG ON A LILY PAD



12-7

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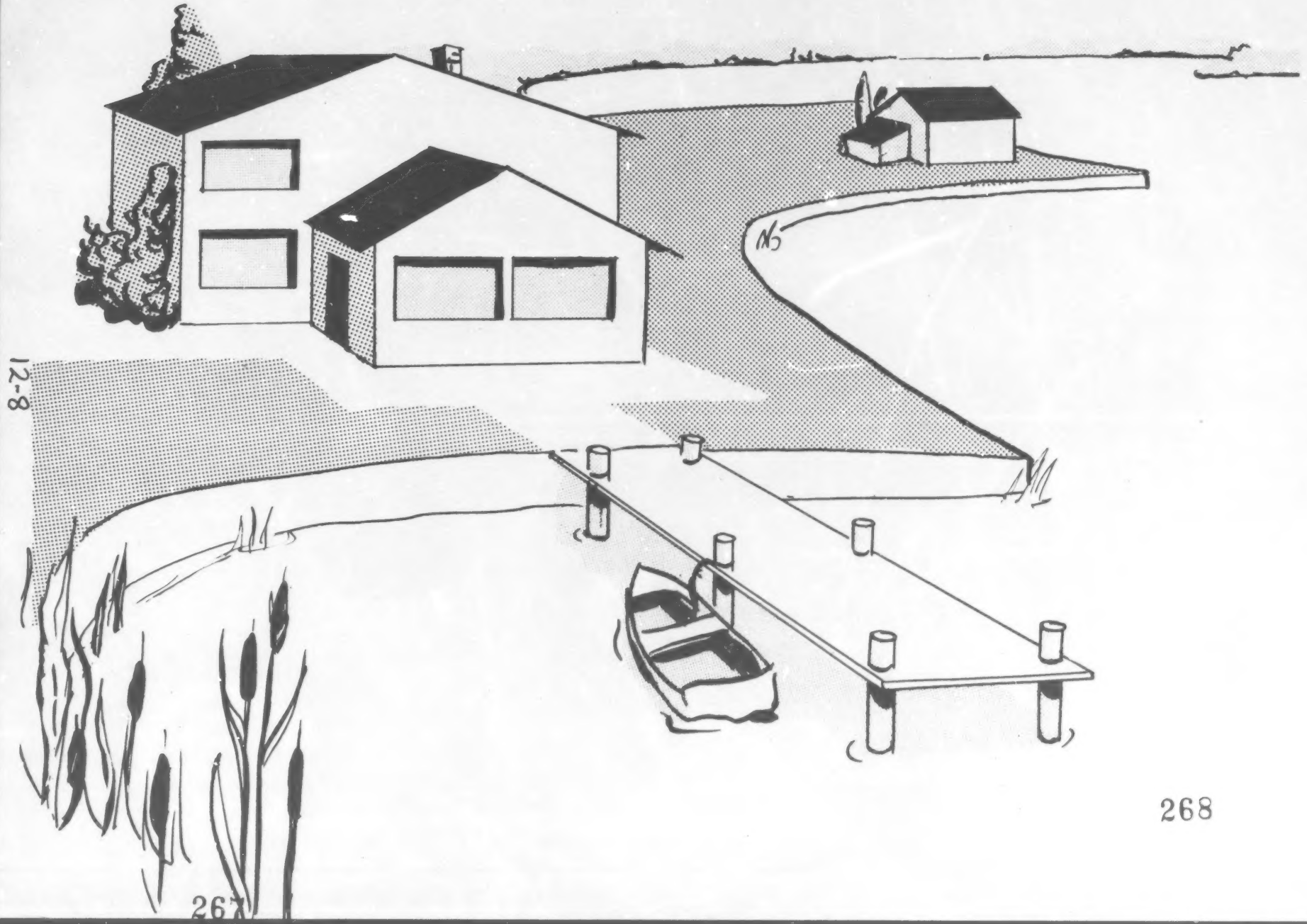
SUMMER HOME ON A MARSH



12-8

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ALLIGATOR IN A SWAMP

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BALD CYPRESS SWAMP
12-10
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FUR COATS AND ALLIGATOR SHOES

12-11